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ABSTRACT

It is widely believed that television viewing has a negative impact on school achievement. This belief is supported by negative statistical associations sometimes found between school achievement and amount of television viewing; that is, heavy TV viewers tend to show poorer achievement than light viewers. One possible explanation of this association is that television viewing has a detrimental effect on cognitive development. This research review extensively examines this possibility. The research literature examined included work on: (1) the cognitive nature of children's television viewing, including viewing behavior, attention, comprehension, and arousal; (2) the effects of television viewing, including displaced activities, general knowledge, attentional processes, task perseverance and impulsivity, creativity and imagination, and reading; (3) modifiers of these effects, particularly coviewing by parents, and critical viewing skills programs; and (4) the relationship of these effects to schooling. The review concluded that analysis provided little support for most of the common beliefs about the negative influence of television on children. However, the conclusion that television had no major effects was difficult to support, since the review also reported that little research has been conducted on several major issues, including the influence of entertainment television on children's academically relevant knowledge. Also, reported was that some of the existing research could be challenged on methodological grounds. In addition, the review offers a research critique and suggestions for future research. (Sixteen pages of references are appended.) (MM)

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Working Paper No. 2

The Impact on Children's Education: Television's Influence on Cognitive Development

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The Impact on Children's Education:

Television's Influence on Cognitive Development

by

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Executive Summary

It is widely believed that television viewing has a negative impact on school achievement. This belief is supported by negative statistical associations sometimes found between school achievement and amount of television viewing; that is, heavy TV viewers tend to show poorer achievement than light viewers. One possible explanation of this association is that television viewing has a detrimental effect on cognitive development. This paper extensively examines this possibility.

There has been widespread public commentary about the cognitive effects of television. A number of assertions are common throughout this commentary and are examined in this paper. These assertions are: 1) Television has mesmerizing powers over children's attention; this power is exerted by the movement, color, and visual changes typical of television. 2) Children's comprehension of television is extremely poor; they remember only disconnected images. 3) Children do not think about television programs, that is, they do not engage in inferential and reflective thought while television viewing. 4) Children get overstimulated by television; by some accounts this leads to hyperactivity, and by other accounts this leads to passivity. 5) Television viewing displaces valuable cognitive activities, especially reading and homework. 6) Attention span is shortened, probably because of the rapidly paced visual images. 7) Creativity and imagination are reduced; in general, the child becomes cognitively passive. 8) Reading achievement is reduced. 9) The development of the left hemisphere of the brain is deleteriously affected because television viewing activates the visual, spatially oriented right hemisphere.

In this paper we examine the scientific research relevant to these and other assertions. The research literature includes work on: 1) The cognitive nature of children's television viewing including viewing behavior, attention, comprehension, and arousal; 2) The effects of television viewing, including displaced activities, general knowledge, attentional processes, task perseverance and impulsivity, creativity and imagination, and reading. 3) Modifiers of these effects, particularly coviewing by parents, and critical viewing skills programs. 4) The relation of these effects to schooling. We conclude the paper with a critique of the research area and suggestions for future work.

With only a few exceptions, the research literature on any one issue is sparse. In considering the common assertions about television we found:

1) There is no evidence that television has a mesmerizing effect on children's attention caused by color, movement, and visual changes. Rather, children's attention to television is quite variable, and appears to be strategically guided in the service of comprehension of the TV program, as well as participation in concurrent activities. While

attention is attracted by features such as movement, these effects are small as compared to, for example, comprehensibility of the content or the presence of humorous content.

2) While preschool and early elementary school-age children's comprehension of television can be fragmented, this holds primarily for relatively complex adult-level dramatic presentations. Programs produced for young children consisting of brief segments are readily understood by preschoolers, who also can understand some longer situation comedy type programs. The assertion that comprehension is poor is only partly verified.

3) Even preschool children demonstrate frequent inferential activities while television viewing. Conversations between children in their homes indicate that they do speculate about program resolutions, character motives, and the relation of prior scenes to those subsequent. These inferences are not always accurate and are limited by children's experience with television and with the subject matter being portrayed. Contrary to popular assertions, children are cognitively active during television viewing and attempt to form a coherent, connected understanding of television programs.

4) There is no evidence that children generally get overstimulated by television. Children look away from TV frequently, and often leave the viewing area, these behaviors allow reduction of potential overstimulation. Self ratings from TV viewers generally indicate relative relaxation, although some television content can be arousing.

5) There is little evidence that television viewing displaces valuable cognitive activities. The clearest evidence indicates that viewing displaces movie attendance, radio listening, comic book reading, and participation in organized sports. Homework, however, is often done concurrent with TV viewing. There is no evidence that homework done during television viewing is of lower quality than homework done in silence.

6) The assertion that television viewing shortens attention span is difficult to test since the term "attention span", as commonly used, has no certain technical meaning. Nevertheless, a number of investigations indicate that television may increase attention focusing capabilities. Other scattered research indicates TV viewing may affect task perseverance and impulsivity, but some of these studies indicate a positive effect and others indicate a negative effect. The effects may depend on which types of programs are watched: Viewing violent action programs may cause reduced perseverance and viewing educational programs may cause increased perseverance.

7) There is no clear evidence that television influences imaginativeness, but one study indicates that television may negatively affect verbal "ideational fluency", i.e., ability to think of alternative uses for an object. There is also mixed evidence that children may be more imaginative immediately after listening to the radio than after watching TV. There has been no research on television's effects on productive cognitive skills, such as writing, and in general, there is no evidence that television makes children cognitively "passive".

8) There is some weak evidence that television availability reduces reading achievement. If this effect actually occurs, it appears to occur during the early elementary school years and is probably temporary. Relative to other factors, such as family encouragement of reading, the effect of television on reading achievement appears to be small if it is in fact real. Related to this issue, there is mixed evidence that television viewing increases vocabulary acquisition.

9) There is no evidence that television asymmetrically influences brain development.

The research literature provides little support for most of the common beliefs about the influence of television. For a number of reasons, however, it is difficult to conclude that television has no major effects. First, there has been almost no research on a number of major issues, including the influence of entertainment television on children's academically relevant knowledge. Second, considerations of what is known about television viewing suggest possible negative effects (for example, on listening skills) that have not been explored in research. Third, some of the existing research can be challenged on methodological grounds.

The problem of television's cognitive influence is tractable and solvable by new research approaches. In particular we recommend that future research consider the cognitive activities involved in television viewing itself in developing hypotheses about effects that may transfer to other domains.

The Impact on Children's Education:

Television's Influence on Cognitive Development

by

Daniel R. Anderson Patricia A. Collins

Introduction

Public discourse on the influence of television includes substantial concern about negative effects on cognitive development and consequently on education. Common propositions include "TV makes children intellectually passive", "TV shortens children's attention spans", "TV hypes kids up, makes them restless in the classroom", "TV hypnotizes children", "TV displaces reading and other valuable intellectual activities", and "TV reduces imagination and creativity". When national achievement test scores decline, television is blamed. When they rise, television has no role. While specific television programs or series are sometimes praised as benefitting cognitive development, television in general is not. This belief in the negative influence of television has considerable historical precedent.

Media used by children for entertainment are blamed, at the peak of their popularity, for the perceived problems of childhood. Books, magazines, comic books, movies, radio, board games, and computer games have all been suspected of undermining intellectual thought and the educational process (cf, Greenfield, 1984; Morgan & Gross, 1982; Wartella & Reeves, 1985). As an example, comic books were blamed for an apparent decline in reading skills during the 1950's. The ostensible problem was "linear dyslexia" caused by vertical movement of the eyes between cartoon figures and text balloons (see Gilber, 1986). In the 1970's and 80's television was accused of producing reading deficits because children did not get enough practice moving their eyes (Moody, 1980). There is a certain historical consistency in popular concern about the influence of entertainment media for children.

Recognizing the historical cyclicity inherent in modern concerns about television does not disqualify the question: What are the influences of television on cognitive development? There are plausible reasons to believe that television might in fact have effects. One reason is the observation that many American children spend large amounts of time with television, such large amounts of time that it is virtually a cliche to point out that children spend more time with TV than they spend in school (e.g., Dorr, 1986). It is hard to believe that such an investment of time has neither cost nor gain. A second reason is the observation that television viewing is often negatively (and sometimes positively) associated with school achievement (Morgan & Gross, 1982). While associations do not by themselves indicate that TV viewing affects achievement, they indicate that an impact on achievement and on cognitive development is possible. For these reasons alone, the question of television's influence on cognitive development deserves examination in depth.

The examination does not yield the simple propositions characteristically given by the journalists, social critics, psychologists, physicians, and educators who write articles for popular magazines. On the whole, we will conclude that many common assertions about children's TV viewing are wrong, and that evidence for cognitive effects, negative or

positive, is weak.

Rather than rhetoric supported by anecdote and bolstered by unstated political and social bias, we believe that the question of television's cognitive effects should be approached by careful empirical observation and analysis combined with clearly stated and testable hypotheses and theory. Methods and procedures must be fully described with data and analyses reported in detail. In other words, we believe that the question of television's effects should be approached scientifically with proposed answers open to informed debate based on rules of evidence. To many, this approach is obvious and they assume there *must* be a large scientific literature on the cognitive effects of television. They further assume that assertions made in the popular press stem from such work. Unfortunately, however, a scientific approach has informed little of the discourse on the cognitive influence of television. There is, in fact, only a small relevant research literature and that literature yields only a few firm conclusions. Hornik's (1981) excellent review of the influence of out-of-school television on schooling came to essentially the same position. The scientific question of the influence of television on cognitive development, much less on schooling, remains largely to be answered.

In this paper we provide a review of that limited literature, indicate the broad areas where research and theory are lacking, and suggest some new approaches. We also consider the difficulties of research on the cognitive influence of television and suggest approaches to dealing with those difficulties. Our hope is that this paper will help cast the problem, although complex, as being tractable. The difficulties are substantial, but we are confident that they can be overcome and that the answers obtained will be worth the effort. Before considering the effects of television, however, we will very briefly review contemporary thinking about cognitive development.

Cognitive Development

Based on numerous empirical disconfirmations, contemporary developmental theory has backed away from positing the discrete all-encompassing stages of logical thought as originally advocated by Piaget. Instead, cognitive development is currently seen as following a number of independent parallel courses within specific domains (e.g., Keil, 1984). Development within a domain depends heavily on experiences relevant to that domain, with a growing theoretical emphasis being placed on the role of adults' implicit and explicit teaching (e.g., Brown & Campione, 1984) as well as specific aspects of the cultural milieu (e.g., Cole, 1985). Along with a general growth in the child's knowledge base of facts, relationships, procedures and scripts, there is an acquisition of strategies of cognition (e.g., rehearsal in memory), and metacognition (knowledge of the circumstances appropriate to the use of a given strategy, Flavell, 1979).

There has been relatively little current emphasis on the growth of basic cognitive capacities, although some theorists have argued the basic capacity to hold and manipulate information in short term memory increases with development (e.g., Case, 1978). Others have argued that this apparent increase is due to sophisticated representations based on experience which allow the child to "chunk" or organize information, freeing up cognitive capacity (e.g., Chi, 1978; Sternberg, 1985). The story schema is an example of such an organization strategy; children who have acquired an elaborated story schema generally are able to recall more of the story than children who have not acquired a story schema (Mandler, 1984). Even the great increase in general speed of cognitive activity that is observed with age can often be attributed to the automatization that comes with experience (e.g., Sternberg, 1985), although some increase in speed may be based in neuro-

physiological maturation (e.g., Case, 1984).

In sum, contemporary theories of cognitive development heavily emphasize the role of experience in forming the knowledge base, in creating strategies and metacognition, and automatizing mental processes. The child, then, can be viewed as similar to an adult in cognitive potential except lacking the rich and organized knowledge base, cognitive strategies, and repertoire of automated cognitive processes. Beyond about two years, little role in most contemporary theory is given to purely maturational factors as being important for cognitive development.

With regards to the influence of television, mainstream researchers in cognitive development have not even speculated that television is a significant factor. In a recent massive and definitive 942 page review of research and theory on cognitive development (Mussen, 1983), there is only one mention of television (which asserts that little is known about the process of social learning from TV), and in three recent texts on cognitive development, two do not mention television at all (Flavell, 1985; Siegler, 1986), and the third examines cognitive processes involved in viewing television but not possible effects of viewing (Daehler & Bukatko, 1985). Given the importance attributed by contemporary theory to the role of experience, however, potential effects of TV viewing on cognitive development could be hypothesized, but the issue has simply not received consideration.

A Framework for Considering Television's Effects

While hypotheses about television's effects abound and can each be independently examined, we believe such hypotheses should be evaluated within a comprehensive conceptual framework. Such a framework should include the examination of potential mechanisms of influence. An analogy may be made with medical research: Through correlational epidemiological studies, one may examine hypotheses that a given disease process is associated with particular lifestyles or environmental contaminants. Acquired immune deficiency syndrome (AIDS), for example, is associated with homosexual behavior, and lung cancer is associated with cigarette smoking. Finding such associations and determining whether implicated factors play causal roles is an essential aspect of the process of understanding the disease and its causes, but is not by itself sufficient.

What is also needed is an understanding of the mechanisms of the disease process, that is, the proximal chain of cause and effect that produces the final outcome. Findings that a virus is part of the proximal cause of AIDS and that volatile organic compounds in cigarette smoke are part of the proximal cause of lung cancer represent highly important advances in understanding the diseases and are essential in developing treatment and prevention regimens.

Returning to the effects of television, correlational and quasi- experimental research demonstrating relationships between TV viewing and aspects of cognition and school achievement (cf, Hornik, 1981; Morgan & Gross, 1982; Williams, 1986) is highly valuable in determining whether there are phenomena worthy of concern. Such research, through partial correlation procedures and causal modeling, can also provide some indication of which factors may be causal. It cannot by itself, however, indicate the mechanisms of influence and clarify the proximal chain of cause and effect. Clarification requires field observation and laboratory experimental research directed at the behavioral and cognitive details of TV viewing with an emphasis on the mechanisms of retention, transfer, and carryover from TV viewing to other contexts, especially school. Such a conceptual framework of proximal cause and effect should cover four major areas:

1) Television viewing itself should be carefully described in behavioral, cognitive, and developmental terms. The nature of cognitive engagement with television content of varying kinds should be described as a function of the viewer's cognitive status. A moment by moment account should be made of the cognitive processes involved in attending to, comprehending, and anticipating content. In addition, engagement in concurrent activities during TV viewing should be described. From such an account we can understand the cognitive processes which are and are not activated during television viewing. Such a description can be used to evaluate claims that TV viewing is an intellectually "passive" activity, "mesmerizing" to young children, or displaces valuable cognitive activities. A detailed account of television viewing behavior, then, will help to formulate and understand the mechanisms of transfer to other contexts, including school.

2) Accounts of short- and long-term effects should be developed with explicit reference made to the processes identified in the description of children's television viewing. If a relationship is hypothesized between TV program pacing and the child's ability to maintain attention, for example, there should be an explicit set of propositions enumerating the ways in which pacing activates or deactivates attentional mechanisms and how this might transfer or carry over to other contexts. Furthermore, a distinction between short- and long-term effects and the mechanisms by which they are obtained is necessary. This follows from several lines of prior research. Studies of memory for text and for real life experience, for example, indicate that memory for discourse varies substantially if tested immediately or after a delay of several weeks (e.g., Myles-Worsley, Cromer & Dodd, 1986; Kintsch & van Dijk, 1978).

3) Conditions that modify the effects specified above should also be described. It is virtually certain that memory, carryover, and transfer effects are modified by the viewers' experiences with other people and by activities both within and outside of the television viewing setting.

4) Understanding the effects on schooling will require an additional explicit account specifying the nature of interference with, or enhancement of, instructional methods and/or educational goals. Development of this account is of necessity dependent on progress in the other three areas, although empirical demonstrations of television's effects on particular content areas of schooling can point to appropriate topics of concentration. A complete account must distinguish between motivational, social, cognitive, and metacognitive effects of TV viewing. Most importantly, a distinction should be made between direct effects of TV viewing (changes in attentional dispositions, enhanced knowledge base, etc.), and indirect effects due to displacement of other cognitive activities. Specification of the consequences of television's effects for various educational goals should relate television's effects to identified processes and knowledge required in the attainment of those goals. For example, the knowledge base acquired from television may affect (positively or negatively) the learning of content in social studies in specified ways, or specified changes in attentional abilities may affect problem solving perseverance in mathematics.

The following sections of this paper will review the research and theoretical literature pertaining to each of these four areas. We will discuss common hypotheses relating to each area, present relevant findings and theory, and attempt to identify plausible areas that have not been examined by research.

A comment is in order about our strategy in selecting research to review. We have

examined all the relevant American research we could find through computer searches of bibliographical data bases as well as a variety of other indexes and bibliographic guides. This is not a simple task since relevant work is done in a variety of disciplines and is reported in a large number of research journals and professional books. We have probably missed some relevant work, especially in unabstracted chapters in professional books. We have reported as much relevant foreign research as we could find, but we cannot guarantee anything approaching complete coverage, especially for research which is not indexed and abstracted in English. Also, we have discussed unpublished research only when it is highly relevant and recent. In particular, we have not cited unpublished conference presentations and dissertations more than a few years old. Finally, we have not reviewed the many investigations which report simple correlations between TV viewing and school performance or IQ. These are summarized elsewhere (e.g., Hornik, 1981; Morgan & Gross, 1982; Neuman, in press; Williams, Haertel, Haertel & Walberg, 1982).

TV Viewing as a Cognitive Activity

In this section we will first discuss television viewing descriptively in terms of observable behaviors, and then, inferentially, based on experiments and studies of attention, comprehension, and arousal.

Behavioral Descriptions of Children's Television Viewing

There are multiple ways one may invoke the concept of "television viewing" as a variable of interest. Some of these are essentially theoretical constructs having characteristics that may be only implicitly defined (Salomon & Cohen, 1978). For many purposes, for example, television viewing is conceived as the uniform absorbing of messages, with the assumption made that the longer a person is in the presence of television, the more messages are absorbed. Given such an assumption, one need only provide a measure of exposure to television, as well as a measure of messages presented on television, to provide a complete accounting of television's effects. This set of simplified assumptions appears, for example, to be the basis of much of the early work of Gerbner and his colleagues concerning the "cultivation" effects of television (e.g., Gerbner & Gross, 1980).

To some extent, a simplified concept of television viewing is a necessary and unavoidable step in accounting for television's effects. We argue, however, that knowing what actually goes on while children are with television is essential to understanding the proximal chain of cause and effect, without which a complete and accurate accounting of television's impact is impossible. Part of that understanding must come from qualitative and quantitative descriptive research based on direct observation of television viewing itself. Issues that have been examined through direct observation include time children spend with TV, activities carried on while with TV, what children talk about during TV viewing, and patterns of looking at TV.

Time spent with television. At the most general level, a description of children's television viewing must provide an accurate accounting of how much time is actually spent with television. Unfortunately, most of the techniques used to estimate this fundamental descriptor are indirect, have not been validated, and only modestly agree with each other.

As an example, Anderson, Alwitt, Lorch, and Levin (1979) asked mothers of preschool children to estimate the amount of time their children "watched television" in two different ways. One technique required the parents to estimate the amount of time their

children watched TV during each 6-hour block of the day, each day of the week, during a "typical" recent week. The other technique used a recent *TV Guide* and required the parent to check off each show the child watched and the frequency with which the child watched. Both techniques allowed estimates of the number of hours the child watched television weekly, and both techniques are widely used in research on children's television viewing. The first technique produced an estimate of 24.3 hours and the second produced an estimate by the same parents of 32.7 hours, with a modest correlation of .77 between the two estimates (if the correlation seems substantial to the reader, keep in mind that these estimates are being made by the same parents within the same questionnaire). Without further information there is no way to determine which estimate was closer to the truth.

Asking preschool and young elementary school children themselves is not necessarily an improvement. There is little agreement between children's estimates of their own viewing as compared to estimates of the children's viewing by their parents: The correlation is close to zero (Greenberg, Ericson & Vlahos, 1972). Young children appear to have little ability to estimate the time they spend in activities (Medrich, Roizen, Rubin & Buckley, 1982). Simple parental global judgements of amount of time spent with TV, on the other hand, may also be poor measures of time spent with TV. Anderson, Field, Lorch, Collins, and Nathan (1985) found that parent global estimates of TV viewing correlated relatively poorly with videotape observations of children's viewing, and were generally overestimates. These, by and large, are the kind of estimates used in research relating TV viewing and school achievement.

Until very recently, the major technique used by the commercial ratings services to assess children's television viewing is a daily viewing diary marked off in 15- minute blocks. Recently, Anderson et al. (1985) and Choi, Anderson, Burns, and Collins (1987) examined the relationship between parent-kept diary reports and viewer presence as determined from time-lapse videotapes recorded over 10- day periods in the homes of 99 families with preschool children in Springfield, Massachusetts. They found generally good agreement, with very little mean deviation between videotape estimates and diary estimates. For family members only, (not including visitors), correlations ranged from a high of .88 for 5-year-old children who were the focus of research efforts, to a low of .64 for preschoolers who were not the focus of the research efforts. The correlations for the other age groups were .71 for school-aged children (6 through 11 years), .77 for adolescents (12 through 17 years), and .82 for adults. These relationships suggest that viewing diaries are moderately good instruments for measuring total amount of time spent with television. The accuracy of diaries for recording the viewership of particular programs has not yet been examined.

Assuming that viewing diaries reasonably accurately measure time spent with television, the question is then, how much time do American children spend with TV? The answer, unfortunately is still not clear. Ratings services' estimates of viewing are heavily biased by the use of announced "sweeps", measurement periods which occur four times a year. Networks and local stations provide numerous special programs designed to attract the maximum possible audiences during these periods. Estimates of child audiences based on these figures must be considered overestimates of typical viewing. During the 1980 - 1981 viewing season (when the Anderson et al., 1985 time-lapse videotapes were recorded), the Nielsen Television Index reported 27.8 hours for children aged 2 through 5 years, 24.3 hours for children aged 6 through 11 years, and 23.0 hours for teenagers. Viewing diaries from the research in Springfield, on the other hand, indicate figures which are only about 60 percent of those reported by the ratings services. These lower figures are also in line

with those of Singer and Singer based on diaries collected in the New Haven area (Dorothy Singer, personal communication). Huston, Wright, Rice, Kerkman, and St. Peters (1987), used viewing diaries in a study of 3- to 7-year-olds in the Kansas City area and reported viewing ranging from 15.5 to 20.8 hours. Timmer, Eccles, and O'Brien (1985) used a day- after recollection technique similar to the viewing diary, based on a national representative sample examined in 1981 and 1982. Without defining terms, they distinguished TV viewing as a primary activity or as a secondary activity. As a primary activity, TV viewing occupied 13.3 hours for preschoolers, 15.6 hours for 6 through 11-year-olds, and 15.8 hours for 12 through 17-year-olds. Details on TV viewing as a secondary activity were not provided, but combining primary and secondary viewing, children of all ages spent an average of 18.6 hours per week with TV. These figures are also considerably lower than those of commercial rating services.

In sum, we have substantially discrepant estimates of how much time children spend with television. National commercial rating services, which probably provide overestimates, indicate average numbers of hours per week in the low to mid 20's, and academic researchers, using similar procedures, report numbers in the mid to upper teens. A difference of ten hours per week is substantial and the discrepancy deserves resolution. Nevertheless, even the lower estimate represents large amounts of discretionary time spent with TV such that the opportunity clearly exists for television to exert an influence on a large number of children.

Entering, exiting, channel changing. Reports of TV viewing at home, based on actual observation of viewing behavior, consistently comment on the observation that children frequently exit and then reenter the viewing area while the TV program is on (e.g., Allen, 1965; Anderson & Field, in press; Bechtel, Achelpohl & Akers, 1972). Anderson (1987) provided the first quantitative analyses of this phenomenon. Based on video observations of 53 families, he reported that preschool children average 8.3 minutes in the viewing room before exiting, and school age children average 7.6 minutes. While lengthy uninterrupted viewing sessions are not uncommon, it is clear that children are likely to be absent during some part of a half-hour or hour TV program.

Another way for the viewer to interrupt the continuity of programming is to change the channel. While even preschool children are observed to change channels during viewing sessions, the frequency of doing so is not known. Anecdotes of children (and adults) restlessly skipping from program to program abound in the popular literature, but documentation of this phenomenon is lacking.

Concurrent activities. Despite popular stereotypes of children just sitting and staring at the television (e.g., Mander, 1978; Moody, 1980; Winn, 1977) it is common for children to engage in other activities while with television (Allen, 1965; Anderson & Field, in press; Bechtel et al., 1972). As yet, however, there have been no quantitative descriptions of these concurrent activities based on direct observation. Activities of children which are commonly observed include talking with others, eating, playing with toys, coloring, reading, game playing, rough-housing, personal grooming, sleeping, and doing homework. Based on analyses of our time-lapse videotapes, we estimate that approximately one-third of the time school-aged children spent with television was actually devoted to concurrent activities (Anderson, Lorch, Field, Collins & Nathan, 1986).

There have been only a few studies of conversations which occur during television viewing, and these studies have generally provided little quantitative information. Lemish and Rice (1986) observed the home television viewing behavior of 16 very young children

from 6 to 29 months of age. They found that most viewing was shared with adults, and noted that there was considerable language interaction including naming objects, identifying familiar objects, repeating new labels, asking questions, and relating TV content to the child's experience. Amount of talk was related to the program being watched, with *Sesame Street* eliciting the most verbal interaction.

Alexander, Ryan, and Munoz (1984) observed siblings between the ages of 2 and 16 years at home with television. While most conversation was not related to television, there was frequent interpretation and evaluation of TV programs, with the older child interpreting for the younger. Younger children frequently asked questions concerning character identification, narrative conventions, and visual techniques. Prediction of events on the TV program was common.

Reid and Frazer (1980) observed five- to eleven-year-olds viewing at home with their families. They state, "...little uninterrupted viewing was observed...television viewing has an ongoing, emergent character consisting of many interacting and competing activities and events." Some of these activities are play or social interactions with family that incorporate TV content as a point of departure. For example, card playing on TV may lead to card playing by the viewers. Television then becomes the back-drop to the card playing. While quantifying the relative frequency of concurrent activities remains to be done, it is clear that television is not a singular, never-varying activity.

Viewing distance and angles. Children generally place themselves closer to the television than do adults (National Center for Radiological Health, 1968; Nathan, Anderson, Field & Collins, 1985). About 35 percent of children typically view extremely close to the TV (within 6 feet). The angle subtended horizontally by the TV screen at the average viewing distance for children is 12.3 degrees (Nathan et al., 1985); as such, the TV screen is generally framed within parafoveal vision, allowing rapid and accurate identification of visual scenes with a minimum number of eye movements (Saida and Ikeda, 1979). There are probably relatively few eye movements during most TV viewing, although normative quantitative data on this issue are lacking. In formative research for *Sesame Street* utilizing eye movement technology (Flagg, 1978), an abnormally large visual angle of the TV screen (21.7 degrees) was employed in order to get a substantial number of eye movements to measure (B. Flagg, personal communication). As will be noted below, however, children frequently look away from the TV screen, usually to engage in a concurrent activity. The concurrent activity may involve eye movements.

Summary of behavioral descriptions. Observations of children spending time with television do not conform to popular descriptions of the "zombie" viewer. Not only do children probably spend less time with television than commercial rating services estimate, about a third of that time is occupied with activities other than looking at the TV. Although children's conversations during TV sessions are often about topics not related to television, there is nevertheless a great deal of discussion about the events on TV in terms of their meaning, plausibility, and implications for future events. About a third of children sit within 6 feet of the TV set despite numerous warnings to parents in the popular media to view from a greater distance (based on health concerns about radiation emissions from older color receivers). The distance at which children typically view TV is probably optimal for rapid visual identification of scenes with a minimal number of eye movements.

Attention to Television

If television is an influential medium of communication and entertainment, it is so partly by its power to gain and maintain attention. Many writers have argued that children in particular are subject to attentional enthrallment by TV. Moody (1980), for example, in a popular and influential book on television, quotes other writers and herself uses the following terms to describe children's attention to television: addictive, mesmerizing, glazed eyes, drugged, spaced out, and zombies. She notes: "Television does not arouse active attention; rather, TV viewing suppresses it" (p. 17). Typical of such writing, the evidence given is anecdotal and is based on interviews with and quotes from "experts" including a pediatrician, other journalists, a hypnotist, several psychologists, a psychiatrist, and a botanist.

The most common description of a young child confronted with television is that the child stares unceasingly at the screen. In such accounts the child is always seen as a passive recipient who is "controlled" by factors such as rapid cutting, changes in color, and movement. In early theoretical accounts of children's attention to television by academic psychologists, similar notions prevailed. Lesser (1977) referred to the young child's viewing as "involuntary"; Emery and Emery (1976) referred to it as "fixated"; and Singer (1980) emphasized attention as being passive and externally controlled due to the repeated elicitation of the orienting reflex by constant visual novelty. As might be guessed from the behavioral descriptions of children's TV viewing described above, systematic research on attention to television has not verified these notions.

Before we review the research on attention to television, a brief discussion of the concept of "attention" is in order. By most usages, attention is not directly observable since it refers to the direction and intensity of cognitive activities. Cognitive activities, however, usually involve selective processing of the external environment. This processing of the external environment does have observable manifestations in visual orienting and tactual exploration, but some unobservable aspects of attention such as listening and intensity of processing must be inferred. In television research, inferences about attention are made based on recognition or recall, from secondary tasks administered concurrently with TV viewing, from electrophysiological recordings, from self-ratings, and most commonly, from visual orientation toward the TV screen, or "looking".

Looking at television. Visual attention to television has been examined both in "laboratory" experiments and in observational studies in homes. When the laboratory studies create a viewing environment which affords activities alternative to looking at the TV (such as playing with toys), patterns of looking at TV generally parallel those observed at home (Anderson & Field, in press). In the typical study a "look" at the TV is defined as beginning with the onset of a visual orientation toward the TV screen and ending with the offset of the visual orientation. The periods between looks are called "pauses". Looks are usually rated by an observer who views a videotape of the child; the observer presses a button when the child looks at the TV screen and releases it when the child looks away. The button pushes and releases are recorded by a microcomputer and, depending on the study, these records of looks at the TV can be related precisely to the ongoing content of the TV program.

Although infants sometimes look at television (Hollenbeck & Slaby, 1979; Lemish & Rice, 1986), visual attention steadily increases from very low levels during infancy to a maximum during the late elementary school years, declining somewhat during adulthood

(Anderson et al., 1986).

Children generally look at and away from the TV between one and two hundred times an hour; the distribution of look lengths is highly skewed and as a consequence, median look lengths are usually only several seconds (Anderson & Field, 1983). Extended episodes of visual attention as long as a minute in duration are not typical but neither are they rare. Looks as long as ten minutes in duration have been observed but they are exceptional.

Within a given age there appear to be moderately reliable individual differences in visual attention to television (Anderson et al., 1979), and distinct viewing "styles" have been frequently noted (e.g., Bechtel et al., 1972). In our laboratory work with pre-schoolers, we have consistently found that percent visual attention to the TV is positively correlated with Peabody Picture Vocabulary Test (PPVT) IQ (correlations ranging from .2 to .4. We also found a positive correlation of .26 for 5-year-olds observed at home over 10-day periods by means of time-lapse videotape. We have examined the correlation with older children in only one study (Field & Anderson, 1985); for 9-year-olds it was .27. We have not found any evidence, however, that percent visual attention is correlated with the amount of time spent with TV; correlations are near zero (Anderson et al., 1985; Anderson et al., 1986).

With regard to look length, Anderson et al. (1979) described a phenomenon they called "attentional inertia". They pointed out that the longer a look is in progress, the more probable it becomes that the look will remain in progress. In particular, a plot of the conditional probability that looks will survive through each successive interval of time after they have begun shows a negatively accelerated increasing curve which levels off after about 15 seconds. This pattern is characteristic of individual viewers from young children through adults, and is found in home observations as well as in laboratory studies (Anderson & Field, in press). Anderson and Lorch (1983) demonstrated that the longer a look is in progress prior to a content boundary (as, for example, between segments of *Sesame Street*), the more likely it is that the look will remain in progress after that content boundary. Content boundaries otherwise tend to terminate looking at the TV. Anderson and Lorch (1983) argued that attentional inertia thus serves to maintain attention across changes in content. As we will see below, attentional inertia may be indicative of increased cognitive engagement.

There have been a number of investigations concerning the characteristics of TV programs that influence children's looking at television. These investigations have generally concerned two issues: program comprehensibility and noncontent features characteristic of television as a medium.

Effects of program comprehensibility on looking. Comprehensibility is an influential factor in determining whether a child looks at a TV program. Anderson, Lorch, Field, and Sanders (1981), for example, found that preschoolers' visual attention was higher during dialogue with immediate ("here and now") referents than it was during dialogue with nonimmediate referents which are more abstract and thus less comprehensible to very young children. Rice (1983, 1984) proposes that programs using relatively more of these immediate referents might be more effective in teaching vocabulary because they are similar to mothers' speech to their children. Furthermore, it may be the similarity to mothers' speech that makes this content more comprehensible. In any case, the observed increase in attention to these segments should augment any vocabulary learning from them. Anderson et al. (1981) also found that visual attention was greater during normal

segments of *Sesame Street* than if the segments had their comprehensibility experimentally reduced by using backward speech or foreign language. Randomly ordering scenes within segments of *Sesame Street*, however, had only marginal effects on visual attention, a manipulation which was rated by college students as leaving considerable residual comprehensibility. Other studies have replicated these effects with the exception that no effect of randomly ordering scenes was found (Lorch & Castle, 1986; Pingree, 1986).

Campbell, Wright, and Huston (1987) experimentally manipulated comprehensibility of short TV segments by employing several levels of sentence complexity, abstractness, and amount of message redundancy. They found only small and nonsignificant reductions in attention with increasing difficulty. It appears, therefore, that while the program must be locally comprehensible before a child will attend to it, normal variations in comprehensibility have only small effects. This conclusion must presently be limited to comprehensibility variations within segments of less than a minute's duration, since the cumulative effects of material which is difficult to comprehend have not yet been examined. Longer, difficult-to-understand material may progressively lose attention over a several minute period; such an effect was found by Hawkins when he reanalyzed Pingree's (1986) data (Robert Hawkins, personal communication).

The influence of formal features on looking. The second set of variables that have been investigated as possible determinants of looking are various "formal features". Research groups at the University of Massachusetts and at the University of Kansas are primarily responsible for this work. Formal features are defined as characteristic attributes of the medium which can be described without reference to particular content. Attributes which have been examined include voices of different types (e.g., adult male or female voices), music of different types, animation, cuts (sudden visual changes due to editing or camera switches), zooms, sound effects, and so on.

Results of research on formal features have been surprisingly robust, with each research group generally replicating the other's findings. Features that are consistently positively associated with visual attention include children's voices, peculiar voices, sound effects, auditory changes generally, and visual movement. Consistent negative features include men's voices, long zooms, and inactivity (cf, Alwitt, Anderson, Lorch & Levin, 1980; Anderson & Levin, 1976; Calvert, Huston, Watkins & Wright, 1982; Campbell et al., 1987; Susman, 1978). Both research groups have noted the importance of auditory features in determining visual attention, and both have argued that the attentional value of many of these features are a consequence of children's learning about the medium of television through long exposure.

One piece of evidence that children learn to attend in the presence of some formal features and to suppress attention in the presence of others, comes from Levin and Anderson's (1976) demonstration that these effects are largely absent in children under about two and a half years of age. If the formal features catch and hold attention by means of innate and unlearned attentional mechanisms such as the orienting reflex (Sokolov, 1963), then one would expect the effects to hold for such young children as well. Another item of evidence comes from the finding that visually inattentive 5-year-olds are much more alike in terms of the specific points at which they look up at *Sesame Street* than are visually inattentive 3-year-olds (Anderson, Lorch, Smith, Bradford & Levin, 1981), suggesting that the older children have learned that specific auditory cues indicate the presence of interesting content.

Formal features may serve several purposes in children's cognitive processing of television. Anderson and Lorch (1983) and Huston and Wright (1983) have hypothesized that formal features are correlated with particular kinds of content which are significant from the child's perspective. Thus the formal features may serve the informative function of indicating the likely presence of that content. Anderson and Lorch (1983), for example, hypothesize that men's voices generally are correlated with adult-oriented content which is less comprehensible and thereby less interesting to the child. The visually inattentive child, hearing a man's voice, and having learned that men's voices are correlated with uninteresting content, is less likely to look up at the TV. Such a strategy is efficient, particularly for the child who is time-sharing TV viewing with another activity such as toy play.

Huston and Wright (1983) suggest that formal features also play a role in structuring the flow of content for the experienced child TV viewer. This notion is verified in part by the finding of Alwitt et al. (1980) that when a major content boundary occurs (as between *Sesame Street* segments or the transition from program to commercial), the visually inattentive viewer looks up at the TV and the attentive viewer looks away. Huston and Wright (1983) suggest that learning about formal features is part of a general "media literacy" on the part of the child. The child learns that a given formal feature or constellation of features is unique to a particular series or program genre, or suggests the presence of particular kinds of content (such as exciting action) and is therefore worthy or not worthy of attention.

In addition to formal features and comprehensibility, it is clear that engagement with particular content determines visual attention to television. Content that is rated as "appealing" by children, humor, and some special effects have been demonstrated to increase looking (Bryant, Zillmann & Brown, 1983). In general, Bryant et al. (1983) find that programs which receive high visual attention are also likely to be chosen over others during channel selection by children. Thus, formal features, comprehensibility and appeal of particular content influence children's level of attention to television.

External factors. Factors external to the television also influence children's looking at TV. Not surprisingly, when toys are available during a TV program, visual attention to the TV is lower than when there are no toys (Lorch, Anderson & Levin, 1979; Pezdek & Hartman, 1983). When children view television together, their looking becomes much more synchronous than when they view the same program separately, indicating that they substantially influence each others' looking at and away from the TV screen (Anderson, Lorch, Smith, Bradford & Levin, 1981). Lemish and Rice (1986) noted that parents often direct very young children's attention to events on television. Also, even young children are sensitive to the task demands of a viewing situation and can adjust their visual attention accordingly: Field and Anderson (1985) found that 5-year-olds who were told they would be tested for their memory of a TV program selectively and appropriately increased their visual attention to those parts of the program which did not contain redundant auditory information.

Listening to television. Due to obvious difficulties in measuring auditory attention, much less is known about children's listening to television as compared to looking. The research does indicate, however, a strong relationship between processing the video and audio in children. The coherence of the audio and video information appears to be important in determining visual attention even for infants: Hollenbeck and Slaby (1979) found that 6-month-olds looked less at the TV when the sound track did not match the

video.

As we noted earlier, reducing the comprehensibility of the audio has a strong effect of reducing looking, indicating the importance of semantic processing of the audio while paying visual attention. Apparently, however, children are generally less likely to listen to television at a semantic level of analysis when they are looking away from the TV. This follows from findings that auditory information is more likely to be recalled if the child was looking at the TV at the time the information was presented than if the child was not looking (Field & Anderson, 1985; Lorch, et al., 1979). This linkage between looking and listening, however, weakens with age (Field & Anderson, 1985), indicating that older children are somewhat more likely to listen to a program at the level of semantic comprehension when they are not looking at it. Lorch et al. (1979) hypothesized that young children, when not looking, listen to television at a relatively superficial level of analysis. The children listen for auditory formal features as cues to begin looking.

Strength of attentional engagement. Looking at the TV screen does not necessarily signify strong attentional engagement. The notion here is that even if vision is engaged, attentional involvement can be minimal. This idea underlies characterizations of child TV viewers as having essentially blank minds, or being "spaced out" while they stare at TV. The attempt to measure strength of attentional engagement has produced a number of methodologies of assessing intensity of attention to television. These methods include viewer ratings of involvement (e.g., Csikszentmihalyi & Kubey, 1981; Field & Anderson, 1985; Salomon, 1984), measurement of electroencephalographic (EEG) activity during TV viewing (Krugman, 1971; Mulholland, 1974; Rothschild, Thorsen, Reeves, Hirsch & Goldstein, 1986); examining distractibility during TV viewing (Anderson, Choi & Lorch, 1987); and using interference with a secondary reaction time task as an estimate of involvement with the TV program (Lorch & Castle, 1986; Meadowcroft & Reeves, 1985; Thorsen, Reeves & Schleuder, 1985).

In the absence of a general theory of attention to television, the notion of "-strength" of attentional engagement is really an idea without a precise definition. As such, it is not clear exactly what underlying process each of these techniques measures or how the different techniques are related to each other. In general, the research using these techniques breaks down into two classes: studies which attempt to make broad generalizations about the strength of cognitive involvement during television viewing as compared to other activities, and studies which examine online variations in attentional engagement while watching television.

Common sense notions of attentional engagement suggest that the more a person is attentionally involved with some activity, the less distractible he or she would be. Anderson et al. (1987) applied this notion to preschoolers' TV viewing as a means of determining whether attentional inertia (see description above) is associated with increased attentional engagement. The general question was whether children become progressively less distractible the longer they maintain visual attention to the TV. *Sesame Street* was presented to 3- and 5-year-olds who also had toys with which to play. At irregular intervals a rear projection screen to one side of the TV set presented a slide which would stay on for 4.0 seconds; each slide was signaled by a loud "beep". The children's looks at the TV and headturns to look at the distractor were determined from videotapes. The major result of the experiment was that when the children continuously looked at the TV for 15 seconds or longer, they became substantially less distractible than if they had continuously looked for a shorter period of time. A parallel finding held for the pauses between looks at the TV, which were ordinarily occupied by toy play: If a pause lasted

longer than 15 seconds the child also became less distractible. These and other findings from the experiment were interpreted as indicating that attentional engagement increases over the time course of a look at television, but this increase is also found for the self-generated activities the child engages in when not looking at the TV.

Lorch and Castle (1986) report an analogous experiment using the secondary reaction time task procedure. This technique, which has a long history of use in cognitive research, has only recently been applied to television viewing (Thorsen et al., 1986). The procedure involves instructing a person that when he or she receives a particular signal, to press a reaction time key as rapidly as possible. The reasoning behind the procedure is that if a person is engaged in another activity (such as watching television), the secondary reaction times will be slowed in proportion to attentional engagement with that activity. Lorch and Castle (1986) showed 5-year-olds a specially prepared version of *Sesame Street* which contained normal segments as well as segments which were rendered less comprehensible by random rearrangements of scenes, or using backward dialogue, or using foreign language dialogue. They found that reaction times during normal segments were much slower than during distorted segments, and that, within normal segments, reaction times were slowed if the child had been continuously looking for at least 15 seconds. These results indicate that preschoolers increase their attentional engagement the longer they maintain visual attention to television, but that this effect holds only for normally comprehensible material. This progressive engagement parallels the findings for distractibility reported by Anderson et al. (1987).

The comments by many writers that children can pay rapt attention to television and be undistractible is apparently true. The many interpretations that this effect is produced by movement, color, visual change, and the like are clearly wrong, since the effect holds only for normally comprehensible material, and may also characterize self-generated activities such as toy play.

Meadowcroft and Reeves (1985) used the secondary reaction time task procedure with children ranging in age from five to eight years. The children were shown a cartoon with a complex but regular story structure which consisted of scenes which were either central for understanding the story or which contained incidental information. Reaction times during central scenes were substantially slower than reaction times during incidental scenes indicating that the children were more intensely engaged during the points in the story which were most critical to comprehension.

Taken together, the studies using the distractibility and secondary reaction time procedures indicate that children's attentional engagement during a television program is variable. The variation, however, is selective and appropriate to the content of the TV programs. The longer visual attention is maintained, the child becomes more deeply engaged with the program, but only when the program is comprehensible and especially when the current content is essential to understanding the program.

Popular books on television viewing always cite measurement of EEG to make the case that television viewers are mentally vacant. Emery and Emery (1976), for example, argue that EEG studies indicate that TV viewing simulates severe damage of the left frontal cortex. Usually such claims (most are not quite so extraordinary) are based on the appearance of alpha waves recorded from experimental subjects during TV viewing. Alpha (a regular wave-like pattern of brain electrical activity at about 8 cycles per second) is often found when subjects are awake but relaxed. Alpha generally ceases and is replaced with asynchronous brain electrical activity when subjects are presented with a

novel stimulus which engages attention. This phenomenon is often referred to as "alpha blocking". An important aspect of this research concerns the methodological constraints. A research subject is usually fitted with multiple electrodes and is required to sit as still as possible during the TV viewing session. Particularly with children, this represents a highly unusual and unrealistic form of television viewing.

Most research with EEG has concerned adult viewing of commercials; this work has produced mixed and contradictory findings (see Rothschild et al., 1986, for a review), but generally, reduced alpha during commercials is associated with better recall. Rothschild et al. (1986) additionally showed that alpha blocking was common during adults' viewing of commercials and that sudden visual changes predicted alpha blocking (EEG activity during the program in which the commercials were placed was not reported).

Walker (1980) recorded EEG during 18 adults' viewing of a 3-minute excerpt from a television talk show. There were no significant differences in EEG as compared to 3 minutes of reading, although both reading and TV viewing produced less alpha than sitting with eyes closed or open or during imagination of a beach scene. Shafer (1978) found that the EEG response to an irrelevant flickering on the TV screen was diminished in proportion to the interest value of the ongoing TV program to the viewer. This finding is analogous in some ways to the finding by Anderson et al. (1987) that distractibility decreases as look length increases.

Work by Mulholland (1974) has been widely cited by journalists and others as evidence that children are mentally blank when they look at TV. Mulholland (1974), on the other hand, described his own results as not "definite" (p.5). He described his findings: "We have noticed ... that children watching TV often drop to a rather low level of arousal, with plenty of alpha. The posture is often a relaxed one, especially the facial musculature. This high level of alpha (with the programs we used) led me to speculate that children may be spending a huge amount of time learning how to be inattentive or how to operate at a low level of attention while watching TV before they get to school."- (p.14). He concluded his discussion of television with "more research is surely indicated here, since children spend a huge amount of time watching TV before they start school" (p.15).

A final approach to assessing the intensity of involvement during TV viewing makes use of the viewers' own judgements of their involvement. In research with adults and adolescents, Csikszentmihalyi and Kubey (1981), Kubey (1985), and Larson and Kubey (1983) have employed the "Experience Sampling Method" (ESM) in which an individual carries a paging device and when signaled, fills out a self-report form concerning current activities as well as a variety of subjective states, including concentration, relaxation, and others. They verified previous findings that adults, as well as children, frequently engage in concurrent activities while with TV, and found that subjective states during TV viewing were characterized by "little cognitive investment, and consistently tied to feelings of relaxation, passivity, and drowsiness" (p. 317). Larson and Kubey (1983) examined adolescents' self reports while TV viewing as compared to listening to music (usually rock music). They reported that the level of concentration was about the same for both media. Kubey (1985) considered adults' self reports while reading as compared to TV viewing. There was more sense of concentration, deployment of skill, and challenge during reading as compared to TV viewing. Kubey (1985) also reports that as TV viewing is maintained (over a time course of several hours), concentration declines whereas the opposite effect is reported over several hours of reading. Kubey warns that the latter "spillover" effects should be considered as "tentative".

Salomon (1981; 1983a,b; 1984; Salomon & Leigh, 1984) uses a self-report method he labels AIME (Amount of Invested Mental Effort). AIME is assessed by a short series of questions concerning effort and concentration involved in cognitively processing a given program or medium. In research with children, he found that TV or film viewing generally is reported to require less AIME than reading. These reports, however, can vary: Israeli children generally rate television viewing as more demanding than do American children, and AIME increases if children expect to be tested on the material (Field & Anderson, 1985; Salomon & Leigh, 1984). Kunkle (1981) found that university students report more AIME if they perceive the program to be produced for public rather than commercial TV. In general, then, television viewing is considered by viewers to require little mental effort, especially relative to reading, but this perception is easily changed by situational or other factors.

Since television is more difficult for younger children to comprehend, perceived mental effort expended in viewing should decrease with age. Only one study explicitly compared younger and older children's self-reports of mental effort expended during TV viewing. Field and Anderson (1985) found that 5-year-olds reported more effort in understanding a television program than did 9-year-olds. Both ages increased their reported effort when they were told they would be tested on the material.

Attention to Television: Summary

Direct examination indicates that the popular accounts of children's television viewing are wrong. As a rule, children do not just sit and stare at the television vacantly. Rather, they look at and away from the TV frequently, and their looking is guided by auditory features which they have learned signal program material which is designed for children and is likely to be comprehensible. Visual attention increases over the preschool years, likely reflecting the increasing comprehensibility of television, and brighter children have higher levels of looking. Listening to television at the level of dialogue comprehension appears to be strongly linked to looking in young children, but this linkage gets weaker with age. Intensity of attentional engagement increases the longer a look is maintained, and children adjust the intensity of attentional engagement appropriate to the centrality of the content. Children's attention to television generally appears to be a rational rule-guided activity which acts in the service of comprehension and allows engagement in concurrent activities.

This account of TV viewing stands in contrast to accounts which compare TV viewing to other activities, especially reading. Reports of EEG studies (which are almost entirely limited to adults' viewing of commercials) tend to emphasize relaxation rather than activation effects, even though activation effects clearly occur. Self ratings of cognitive involvement during television viewing are generally lower than ratings for reading. These ratings vary, however, by nationality as well as by the perceived purpose and difficulty of comprehending television. Viewers do not see television as *inherently* undemanding, rather, since television is ordinarily viewed for entertainment and relaxation (e.g., Lyle & Hoffman, 1972), less cognitive effort is devoted to television viewing than reading. Since television is more difficult for young children to comprehend, they may perceive television viewing as a more demanding cognitive activity than older children.

Comprehension of Television

Until recently, research on TV program comprehension has emphasized the deficits in children's understanding, with comprehension frequently seen as "fragmented". Fragmentation of comprehension results from the difficult task of temporally integrating information throughout a TV program. To understand this notion, consider the structure of most entertainment TV programs. A dramatic program or comedy is a half hour to an hour in length, and like a play, can be divided into acts, and within the acts, scenes. Each scene, furthermore, consists of dialogue and action conveyed by sequences of shots organized by techniques of "montage". Montage can consist of abrupt changes between shots (cuts), camera pans to different scenes, zooms to radically different views, fades, overlays, and the like.

Even local comprehension of montage frequently requires inference in order to understand the relationship between shots. As an example, a standard technique of montage is the use of the establishment sequence to identify location and central character. Consider the following sequence taken from a TV program (*Vegetable Soup*) produced for children: From below, a large jet airplane is seen passing far overhead; cut to interior scene of an airliner cabin with a cabin attendant walking down the aisle approaching the camera; pan to the right and zoom to a closeup of a boy looking at a comic book; the boy appears unhappy and anxious. This entire sequence is accomplished in less than 6 seconds. In order to comprehend the sequence, a child must infer that the interior scene is occurring inside the airplane seen the moment before; the inference is therefore one of spatial and temporal relationships and depends on knowledge of standard cinematic practices as well as knowledge about what the inside of a passenger airplane looks like. If comprehension is complete, the viewer will also realize from the pan and zoom sequence that the boy is a main character, and that his emotional expression represents a complication that will subsequently be elaborated and probably eventually be resolved.

From local comprehension of the dialogue and action and from comprehension of montage, the viewer builds up a representation of the content within a scene. As subsequent scenes are presented, the viewer must integrate them with his or her knowledge of prior scenes, including understanding of character motivations, enabling conditions for subsequent events, and so on. Within this welter of information, some of the actions, shots, and dialogue are central for understanding the overall program and some are incidental or nonessential. Comprehension requires discrimination of central from incidental information as well as a great deal of inference in order to build up a coherent cognitive representation of the program. The view of young children's comprehension of television as fragmented was heavily influenced in early research by Piaget's theories of children's story comprehension (cf, Noble, 1975; Wackman & Wartella, 1977). Piaget (1926) claimed that story comprehension by children under about 7 years of age was limited due to a lack of seriation abilities as well as limited abilities to infer and comprehend the transformations which connect an event earlier in a story to those later. The development of seriation (putting events in correct temporal order) and appreciation of transformations are essential, in Piaget's theory, for the development of the story schema. Without the story schema, stories are poorly understood with comprehension fragmented.

As discussed early in this paper, contemporary theory has generally abandoned the notion of cognitive stages fundamental to Piaget's theory. This abandonment was forced by many demonstrations that, with more sensitive nonverbal testing procedures, or with

specialized training, children could be shown to be capable of sophisticated reasoning skills at much earlier ages than Piaget had claimed possible. Furthermore, acquisition of one skill did not predict acquisition of other skills as stage theory implies (see, Mussen, 1983, for extensive reviews). With respect to the development of story comprehension, numerous demonstrations indicate that preschool children have story schemas and that they are able to seriate events from stories (Applebee, 1977; Brown, 1975; Mandler & Johnson, 1977). All this work, however, tends to use very brief stories and specialized testing procedures.

Research on children's comprehension of television has followed this historical trend, with earlier research indicating failure of inference and fragmentation of comprehension, and later research, using new testing procedures, showing more sophisticated comprehension than previously thought (cf. Wartella, 1979). These lines of research, however, are methodologically divergent in a major respect: Earlier research emphasized comprehension of lengthy and complex stories while later research has emphasized local comprehension of very brief pieces up to several minutes in duration. As such, the results of these lines of research are not necessarily contradictory.

In addition to research examining the development of television comprehension, other investigations have considered the influence on comprehension of formal features, co-viewers, perceived cognitive demands, and differences in cultural background. It should be pointed out that nearly all investigations of children's comprehension of television use abnormal viewing conditions, that is, there are no activities available alternative to looking at the television, and the children know they will be tested. As such, comprehension is probably higher than might be expected from normal entertainment viewing, but the difference is also probably not great (Field & Anderson, 1985; Lorch et al., 1979; Salomon & Leigh, 1984).

We will review research on children's comprehension of television beginning with montage, followed by brief segments, and then lengthier relatively complex programs. Subsequently, we will examine the role of formal features, perception of media demands, and cultural background of the viewer.

Comprehension of montage. Most television viewed by children incorporates a great deal of montage. A program that was highly popular with children, *Dukes of Hazzard*, for example, intensively used montage to convey action and meaning. In one randomly selected episode Smith, Anderson, and Fischer (1985) reported there were 556 cuts, 118 pans, 38 zooms, and 63 dolly or truck shots (when the whole camera is moved, as shot from a moving vehicle), such that there were about 16.7 such devices per minute. For connected local comprehension, these techniques of montage demand frequent and rapid inferences of among other things, time, space, implied but not explicitly shown events (called "ellipsis"), and viewing the world from the point of view of one of the characters.

A good deal of early writing argued from Piagetian principles that preschool children should be incapable of integrating montage, and instead should perceive film and television as a set of disconnected images, events, and utterances (e.g., Flapan, 1965; Franck, 1955; Noble, 1975; Zazzo, 1956). Research heavily dependent on verbal explanations by children seemed to support these ideas. Based on such research, Baron (1980) claimed that "eight appears to be the average age when understanding concepts related to TV technique appear. Such techniques as zoom and editing are not well understood by younger children" (p.11). Tada (1969) claimed that "to couple two shots of different camera angles is an intellectual task too difficult for a child of four who just acquired the topological

concept of space" (p.125).

Recently, however, Smith et al. (1985) reported two experiments in which montage was manipulated and young children's comprehension was assessed. Their results contradicted the early claims. In their first experiment, Smith et al. (1985) produced three stop-animated stories in which dolls moved about doll house environments. Control versions of the stories were shot with a still camera and there was no editing, that is, there was no montage. Experimental versions presented the same stories but incorporated pans, zooms, and edits. Comprehension was assessed largely nonverbally by having the children reconstruct the story using the same dolls and sets employed in the original production. The results showed substantial comprehension of the stories by 3- and 5-year-olds, with no differences between the versions incorporating montage and the control versions. Although 5-year-olds reconstructed the stories better than 3- year-olds, the age difference was not attributable to the use of montage.

In their second experiment, Smith et al. (1985) examined the comprehension of montage which required specific inferences regarding simultaneity of action, ellipsis, spatial relationships, and character perspective. They produced 12 brief stories each of which incorporated montage requiring one of these inference types as necessary for comprehension. The reconstruction procedure was again used to assess comprehension by 4- and 7- year-olds. Smith et al. (1985) found generally good comprehension of the montage at both ages, although 7-year-olds were better than the 4-year-olds. The easiest form of montage was ellipsis, and the most difficult form was seeing the world from the perspective of one of the characters. In any case, the authors concluded that even preschoolers are capable of good comprehension of montage.

Cinematic techniques can involve much more complicated elements of montage than those studied by Smith et al. (1985). For example, techniques are used to convey memory flashbacks, distorted perceptions experienced by a character (e.g., a drunk's view of the world), instant replays of events, and so on. Recent as yet unpublished work done by the CRITC research group at the University of Kansas indicates that school age children have difficulty comprehending some aspects of this more complex montage (Wright & Huston, in press).

Salomon and Cohen (1977) argued that specific cognitive skills such as attention focusing, spatial inference, and temporal inference are necessary to comprehend montage. They produced four films which incorporated fragmentation of spaces, logical gaps, closeups, and zooming. They reported that pretests which presumably measured the skills necessary for comprehending these films, predicted fifth graders' comprehension. There thus appear to be individual differences in the skills necessary for comprehension of montage. As we will see in the effects section, it has been postulated that these same skills may benefit from viewing television's cinematic techniques.

Our working conclusion from research on the comprehension of montage is that children are capable of understanding montage during the preschool years and that this understanding improves with age. This improvement with age is likely due to expanded world knowledge of a variety of kinds, as well as knowledge of cinematic conventions gained from experience with film and television. At the most local level, then, children are capable of comprehending television early in the preschool years. Much of this comprehension requires inferential activities concerning spatial relationships, temporal relationships, implied events, and character psychology. At the most basic level of comprehension of television, children go beyond the information provided.

Comprehension of brief segments. Beyond the level of montage, comprehension requires temporal integration of information across shots to form a local representation of activities in a scene or a brief segment. There is little question that even preschool children can comprehend brief television segments that are produced for them. Lorch, Bellack, and Augsbach (1987) carefully analyzed 5-year-olds' comprehension of four *Sesame Street* story segments, using free recall, cued recall, and recognition procedures. They found that the children selectively recalled the idea units that adults considered central to understanding the stories, such that 92 percent of central items were recalled or recognized. In a second study, they compared 4- and 6-year-olds' comprehension of the same four segments: Both ages performed at high levels on central units, but the older children recalled or recognized relatively more than the younger. There were no age differences in performance on incidental (noncentral) units which were recalled and recognized at much lower levels than noncentral units. Lorch et al. (1987) note that if conclusions about comprehension were based on free recall alone, or without distinguishing central from incidental information, a much lower estimate of comprehension would be obtained. Earlier investigations which have concluded poor comprehension of brief television segments produced for young children have generally failed to make these distinctions and have used insensitive testing methods (e.g., Friedlander, Wetstone & Scott, 1974).

Gibbons, Anderson, Smith, Field, and Fischer (1986) used recall and reconstruction procedures to examine comprehension by 4- and 7-year-olds of four specially produced 30-second animated story segments. Gibbons et al. (1986) analyzed comprehension protocols in terms of explicitly presented idea units, central idea units, and inferences relevant to story comprehension. They found high levels of comprehension at both ages, with selective recall and reconstruction of central idea units. Both ages provided many relevant inferences which were plausibly constrained by the stories. The major age difference was that older children recalled a much larger proportion of character utterances than did the younger children. There were no age differences in inferences. The reconstruction procedure was compared to verbal recall: It produced much better performance than recall, indicating the importance of testing procedures for conclusions concerning comprehension competence.

Comprehension of lengthy programs. It is clear that while preschoolers are *capable* of comprehending montage and are *capable* of understanding brief segments or individual scenes, it remains to be demonstrated how well preschool and older children in fact comprehend lengthier programs characteristic of most entertainment television. The evidence is that integrated understanding of such programs is often poor, especially by children under about 8 years of age. Leifer, Collins, Gross, Taylor, Andrews, and Blackmer (1971), for example, found that 4-year-olds were poor at ordering the three most central scenes from a 20-minute film, and Noble (1975) describes similar findings. Collins, Wellman, Keniston, and Westby (1978) reported that second-grade boys showed no evidence of being able to distinguish a normally presented detective show from the same story edited so that the major component scenes were presented in random sequence. In general, comprehension of lengthy programs improves dramatically with age (cf, Collins, 1982).

There are a number of possible reasons for these findings. One methodological possibility is that testing procedures may have been insensitive in assessing younger children's comprehension. Pingree, Hawkins, Rouner, Burns, Gikono, and Neuwirth (1984) used the reconstruction procedure described above and found surprisingly complete and

connected comprehension by preschool children of a family situation comedy. Since the history of research in child development can be well characterized by underestimations of children's capabilities, the possibility is open that comprehension of lengthier programs by young children may be better than generally thought.

There are, nevertheless, a variety of reasons to believe that comprehension substantially improves with age. First, even sensitive testing methods usually reveal age trends. Second, although young children are capable of comprehending montage, Smith et al. (1985) point out that in their investigation, 4-year-olds were correct on an average 62 percent of key inferences and 7-year-olds were correct on 88 percent. In a lengthy program hundreds of local inferences based on montage may be required; cumulatively, enough may be missed to render total comprehension very poor. Wright and Huston (in press) point out that even older children may fail to understand more complex devices such as flashbacks or instant replays. Third, the very nature of television as a "window to the world" is such that children must constantly be exposed to novel material that is difficult to assimilate. Much of what children are exposed to on television is produced for adult audiences, and as such, unfamiliar language, situations, ideas, and actions are common. Failure to comprehend an early scene containing unfamiliar language or ideas will jeopardize comprehension of later scenes, producing a cascading failure of integrated comprehension. Only by about eighth grade is cinematic knowledge, linguistic knowledge, and world knowledge sufficiently developed that comprehension is comparable to adult levels (Collins, 1982).

With such knowledge base issues in mind, it is not surprising that younger children may remember less central content relative to incidental content than do older children (Collins, 1970; Hale, Miller & Stevenson, 1968; Hawkins, 1973). It is clear that this is not a difficulty on the part of younger children in selecting central content, *per se* (Gibbons et al., 1986; Lorch et al., 1987; Meadowcroft & Reeves, 1985), so it is likely that a limited knowledge base restricts the child's ability to discriminate central from incidental information in many programs.

Collins (1982; 1983) has argued that a failure to make relevant inferences underlies much of young children's comprehension failures. In an extensive series of investigations (Collins et al., 1978; Collins, Sobol & Westby, 1981; Newcomb & Collins, 1979) central, incidental, and implicit content of adult dramas was systematically identified by university students. Implicit content was defined as implications and linkages that the viewer must make in order to comprehend the central plot of the drama. The dramas were shown to children from second to eighth grades with comprehension tested by verbal multiple choice tests. General results are that performance on implicit content dramatically improves with age. Detailed analyses indicate, furthermore, "that second-grade viewers are significantly less likely than fifth and eighth graders to infer implicit content, even when they know the explicitly presented information from which the inferences are to be drawn. Indeed, younger grade school children have only performed at, or slightly better than, chance level in these studies" (Collins, 1982, p.15).

It is clear from research using brief television segments that even preschool children readily draw a variety of inferences and form coherent representations. The work by Collins in the context of adult entertainment drama, on the other hand, indicates failures of inference by older children. This discrepancy is not yet resolved, but may be due to: 1) The necessity in complex drama of integrating information over much longer spans of time with a larger amount of intervening material irrelevant to making the inference. 2) The types of inferences in Collins' work appear to be different in type than inferences

studied in research with brief segments. For example, a character's motivations may have to be inferred in order to account for his subsequent criminal behavior. 3) The lack of a rich knowledge base may limit the ability of the younger child to draw inferences. This knowledge base would include familiarity with typical plot structures, general expectations of stories conveyed by television (e.g.,criminals always get caught), and general world knowledge. As an example of the latter, a set of inference questions in one of Collins' investigations concerned a stolen check protector. If a child had no idea what a check protector is, the child would be limited in his or her abilities to draw relevant inferences (e.g., the criminal could then issue fraudulent checks). In addition to ignorance of the adult world, lack of knowledge about adult motives and interactions might also lead to depressed levels of relevant inferences by children viewing adult dramas.

Collins and Wellman (1984) in detailed analyses of children's predictions of the outcome of a program, point out that some of young children's comprehension failures result from a stereotypical or inflexible application of common world knowledge based on expectations stemming from particular events in a recent scene. Older children, on the other hand, are more likely to base their predictions on information specific to the program and taken from a number of scenes throughout the program.

That young children draw on their own background experience in comprehending a TV program was revealed in a study by Newcomb and Collins (1979) which examined lower or middle class elementary school children. The children either saw a TV program representing middle class characters or one representing lower class characters. Newcomb and Collins (1979) found that lower class second graders understood the program with lower class characters better than the middle class children understood that program. Conversely, the middle class children better understood the program with middle class characters than did the lower class children. These differences did not hold for older children. Presumably the older children's greater experiences with television as well as more extensive social knowledge allowed them to understand each show equally well.

In summary, work with lengthy dramatic program material indicates that comprehension greatly improves at least until adolescence. Older children are more likely to selectively recall central idea units and are more likely to make relevant inferences; they are also less likely to have stereotyped expectations based on limited experience. Consistent with contemporary cognitive developmental theory, we suggest that the increase in comprehension is primarily due to expanded knowledge bases rather than to a fundamental shift in ability to identify central content or to make inferences.

Role of formal features. It has long been observed that scenes with salient action and auditory features are more likely to be remembered (Holaday & Stoddard, 1933). A question addressed by recent research is whether general aspects of television's form influence memory and comprehension. The television form consists of visual and auditory modalities, within which occur a variety of characteristic formal features and formats.

At the most general level is the question of whether auditory or visual information is more likely to be remembered. A series of investigations seemed to indicate "visual dominance", particularly in preschool children (Hayes & Birnbaum, 1980; Hayes, Chemelski & Birnbaum, 1981; Pezdek & Stevens, 1984; Smith & Anderson, 1985) such that visual information was more likely to be remembered. If visual and auditory information was conflicting, several experiments found that visual but not auditory information would be remembered by the child (Hayes & Birnbaum, 1980; Pezdek & Stevens, 1984). Gibbons et al. (1986) argued, however, that such demonstrations did not take into consideration the

relative difficulty and abstractness of the auditory as compared to the visual information. Furthermore, the visual information is often in the form of character actions whereas the auditory information is in the form of character utterances. In an experiment with 4- and 7-year-olds, Gibbons et al. (1986) carefully controlled these factors by, for example, using a control condition in which actions and utterances were both presented auditorily with narrated action statements carefully matched to the utterances on a variety of linguistic criteria. The results indicated that actions were generally remembered more than utterances regardless of whether they were presented visually or auditorily. The prior findings of visual dominance were probably due primarily to the salience of action.

Gibbons et al. (1986) did, however, find that younger children's recall and reconstruction of actions, utterances, and relevant inferences were superior with an audiovisual presentation, indicating that presence of moving pictures somehow enhances the formation of an integrated representation of the story. Other less controlled investigations have also found differing patterns of recall and inference for audiovisual versus audio presentations (Greenfield & Beagles-Ross, 1987; Greenfield, Geber, Beagles-Roos, Farrar & Gat, 1981; Meringoff, 1980; Pratt & Mackenzie-Keating, 1985). These investigations have generally added visual tracks to preexisting auditory stories. The complex results were enhanced detail recall combined with reduced inferencing and auditory processing in the audiovisual versions. These latter results are probably due to both information redundancy and overload from the added visual information.

In sum, there is probably no visual dominance in children's memory for television, but since actions are generally more memorable, visual information is normally more likely to be recalled. Audiovisual presentations probably produce more coherent memories in younger children than audio presentations, but adding pictures to an already well formed auditory presentation may provide some distraction.

At a more detailed level of analysis of television's form properties, individual formal features can be examined. Certain auditory and visual formal features apparently can enhance retention of material presented on television. Bryant et al. (1983) found that addition of audiovisual special effects increased information acquisition by 5- to 8-year-old children. They interpret the effect as being due to increased intensity of attention produced by the special effects. Calvert et al. (1982) found that elementary school children who most differentiated certain formal features in terms of their visual attention, that is, increased attention to some, and diminished attention to others, also showed the greatest comprehension of a dramatic cartoon story.

This finding was followed up experimentally by Campbell et al. (1987). They produced several public service type commercials which extolled good nutrition. One version of the commercials was produced in a child-oriented format consisting of animation, sprightly voices, and lively background music. The other version was produced in an adult format employing live photography of real people and objects with narration done by an adult male using a serious tone of voice. The commercials were shown to kindergarten age children and tested for comprehension; the results showed a large effect of format. The children who viewed the commercials presented in a child-oriented format paid greater visual attention and showed better comprehension despite virtually identical content.

In summary, formal features and formats (consisting of particular constellations of features) not only affect attention to television, they also affect comprehension. While some of these effects may be due to reflexive increases in the intensity of attention caused by novel special effects (cf, Bryant et al., 1983; Singer, 1980), many of the effects

can be attributed to learning based on experience with the medium of television. Children learn to pay attention to programs and parts of programs that contain features which signal comprehensible entertaining content (Anderson & Lorch, 1983; Huston & Wright, 1983). This increased attention is reflected in increased learning.

Influence of coviewers. Children commonly view television in the presence of others. Analyses of verbal interactions of coviewers, reviewed earlier in this paper, indicates that conversations between siblings about television are often directed toward issues of comprehension. It is reasonable to suppose, then, that children's comprehension of television might be affected by coviewers.

This supposition is borne out by a number of varying investigations. When coviewing adults are specifically instructed to provide commentary relevant to comprehension, comprehension is increased in both preschool and elementary school children (Collins et al., 1981; Corder-Bolz & O'Bryant, 1978; Singer and Singer, 1974). Studies of *Sesame Street* also report greater learning by children who coview with parents (Ball & Bogatz, 1970; Salomon, 1977). The work by Salomon (1977) with Israeli children indicated that coviewing influences were greater for lower socioeconomic status children. Although coviewing children influence each others' visual attention to television and talk about ongoing programs, we are not aware of any investigations of the effect on comprehension of coviewing with other children. As discussed later, even though it has been shown that adults *can* be helpful to children's comprehension, it is not clear to what extent such helpful interactions between adults and children are common.

Perceived cognitive demands. We have already noted that television is frequently judged by children as requiring little mental effort for comprehension. Salomon (1981; 1983a,b; 1984) has argued that perceptions of low cognitive demand consequently produce little mental effort devoted to processing television. He suggests that processing that does occur is shallower and less elaborated than processing that would occur if television was seen as more demanding. This presumably happens because TV viewing has become highly automatized with years of exposure to the medium.

There is some evidence that this perception of television as "easy" reduces comprehension and retention of television programs. Cohen and Salomon (1979) reported that Israeli children, who had generally had less access to TV, perceived television as more cognitively demanding than did American children, and that the Israeli children retained more content from TV programs. Salomon (1984) found that American sixth-grade children reported investing less mental effort in comprehending a silent film than they did in reading a comparable text. The more self-rated mental effort they expended in comprehending the film, the greater were recognition and inference scores in subsequent testing. Field and Anderson (1985) and Salomon and Leigh (1984) found that telling children they would be tested on the program material increased self ratings of mental effort and also increased retention scores.

Perceived cognitive demands of television may thus be a predictor of comprehension. When a child perceives television as demanding cognitive effort, more effort is expended; this extra effort appears to produce greater comprehension. It may be that under conditions of normal television viewing for entertainment, the perceived demands of television are low, at least for older elementary school children.

Summary of Comprehension

There is little question that preschoolers are capable of comprehending montage as well as brief segments produced for children up to several minutes duration. There is also an indication, using sensitive comprehension procedures, that preschoolers can understand even longer programs of the family situation comedy type. In comprehending television, preschoolers select central content and engage in a variety of inferential activities.

There does not appear to be visual dominance in young children as has been proposed, but there does appear to be selective retention of character actions as opposed to character utterances. Auditory information may be more likely to be retained by young children if it is accompanied by video, indicating that audiovisual presentation may enhance listening or listening comprehension.

Despite the findings of unexpectedly sophisticated comprehension of television by preschoolers and young school age children, there is a great increase with age in comprehension of lengthy child oriented and adult programs. An increase in children's media knowledge and general world knowledge clearly plays a large role in this improved comprehension. Older children better select and retain central content, are more likely to make relevant inferences, and are less likely to interpret content in terms of their own personal background and experiences. Comprehension of some kinds of montage, such as flashbacks and replays, continues to improve throughout the school-age years and probably into adulthood, as novel cinematic techniques are encountered. By about eighth grade children have levels of understanding of entertainment television that approximates adult levels, although it is apparent that increasing world knowledge will add to comprehension throughout life.

Comprehension is influenced by formats and formal features. Judiciously placed special effects increase retention, and children learn more from programs in child-oriented formats than programs with equivalent content produced in adult-oriented formats. Combined with findings concerning attention to television, these results indicate that children acquire a form of media literacy which guides their comprehension activities.

There is some evidence that American children regard the cognitive demands of television lightly, and as a consequence, engage in less elaborate cognitive processing than they are capable. That children are able to readily change their processing, however, is demonstrated by findings that greater effort and increased comprehension occurs when children are told they will be tested for their memory of the content.

In general, research on comprehension of television reveals no major discontinuities with research on comprehension of other media, especially text. The basic communication codes of television are certainly more readily mastered at an earlier age, without explicit instruction, but once the codes are mastered, comprehension develops along similar lines (cf, Rayner & Pollatsek, in press; Salomon, 1983b), with inferential processes and associated world knowledge playing major roles. Television is, of course, different in some important ways. Audiovisual integration, formal features, and format effects probably play greater roles than analogous features do in text (e.g., use of text with pictures; use of italics, underlining, or boldface as formal features; use of child oriented or adult oriented text formats). Also, the primary use of television as an entertainment medium may create different expectations about the appropriate depth of processing necessary for comprehension.

Compared to the startling popular characterizations of children's comprehension of television as passive, fragmented, and virtually nonexistent, systematic research presents a reassuring alternative view. Children make judgements about comprehensibility and interest value, make inferences, interpret content in terms of their own experience, and are more likely to remember central rather than incidental content. When they fail to do so, and such failure *is* common among young children, the most likely explanations are failure to comprehend montage, or simply lack of the relevant background knowledge necessary for comprehension. Each of these components develops with experience. The child's comprehension of television indeed develops, but that development shares much in common with the development of comprehension in general.

Arousal During Television Viewing.

We have already seen that characterizations of children's television viewing as mindless, invariant and undemanding are inaccurate. Another common assertion claims that formal features and pacing lead to heightened levels of arousal. For example, Moody (1980) claims: "Television is an intense kaleidoscope of moving light and sound. It can create extreme excitement in the brain and, after prolonged viewing, it can produce a 'drugged state'..."(p.18). She quotes T. Berry Brazelton, the pediatrician: "...television creates an environment that assaults and overwhelms the child; he can respond to it only by bringing into play his shutdown mechanism, and thus become more passive" (p.18). Very similar ideas may be found in Emery and Emery (1976), Mander (1978), and Winn (1977). The common element in such commentaries appears to be that television is highly overstimulating, producing "hyped up" reactions in the short term and extreme passivity in the longer term. While this issue is not specifically cognitive, it is highly related to the issues of attention, distractibility, and task perseverance.

The evidence on television's role in arousal is very limited. As discussed earlier, children are often behaviorally active when they are with television, engaging in a variety of activities concurrent with TV viewing. There have been no studies as to whether these behaviors are hyperactive or abnormally hypoactive as compared to other behaviors the child engages in. One study suggests that children are less active, earning television its role as "babysitter" (Gadberry, 1974). From our observations, concurrent viewing activities by children appear unexceptional.

Children frequently look away from television, on the order of 150 times an hour (as do adults), allowing opportunities for reduction of stimulation. The pattern of concurrent activities and attentional behaviors typical of children's television viewing do not particularly conform with either the notion of a "drugged state" or passivity. On the other hand, it is not uncommon to observe a child sitting or reclining, quietly watching TV. From our viewing of time-lapse videotapes recorded in homes, we believe these quiet periods occur primarily early in the morning and late in the evening, and we suggest they reflect normal diurnal activity cycles. There are as yet no quantitative analyses to support these qualitative observations.

The EEG studies described earlier do indicate the presence of alpha during TV viewing; alpha is generally associated with a relaxed state and low levels of mental activity. On the other hand, alpha is also observed during reading and many other activities; there is no consistent evidence that alpha is especially characteristic of TV viewing. Viewers are undoubtedly more likely to be relaxed during television viewing than during many other activities, as borne out by a variety of self rating studies reviewed

earlier.

Zillmann (1982) argued that the relaxing or arousing effects of television are due to the meaning of the content to the viewer in relation to the viewer's prior cognitive and arousal state. If a viewer is in a state of stressful arousal which is maintained by repetitive thoughts related to the stress (as in thinking about a bad day at school), then becoming engaged in television content unrelated to the source of stress can block the thoughts that maintain the stress. Alternatively, if the television content is related to the stressful thinking, it can reinforce and increase the level of arousal. Zillmann (1982) reviews a number of investigations with adults that support these hypotheses.

Although entertainment television viewing appears to be generally associated with relaxation, television content can be exciting and increase arousal in both adults and children (Zillmann, 1980). There has, however, been no research on how frequently child viewers' level of arousal is increased by television. In general, however, the lower the initial level of arousal as a viewer watches television, the more likely it is that the content will be arousing (Zillmann, 1982).

In sum, television viewing is capable of both increasing and decreasing levels of arousal. On the whole, viewers are probably relatively relaxed when viewing television, but it is not yet clear whether television causes a relaxed state, or whether viewers watch television at times when they would normally be relaxed. There is simply no evidence that arousal states during television viewing are highly deviant as compared to arousal states during other activities.

Summary of Research on TV Viewing as a Cognitive Activity

The most common assertions about children's television viewing are related to the notion of cognitive passivity. In one form or another these assertions may be found in hundreds of newspaper and magazine articles as well as in books and chapters by Cohen (1972), Emery and Emery (1976), Lesser (1977), Mander (1978), Moody (1980), Schorr (1983), Singer (1980), Postman (1979), and Winn (1977). The assertions are: 1) Children spend enormous amounts of time watching television and doing nothing else. 2) Children's attention to television is involuntary; attention is captured and held by formal features. Children just sit and stare at the TV without regard to content. 3) Comprehension, especially by young children, is passive; there is no reflection and inference. Retention is merely a disconnected set of images. 4) Children get highly aroused and overstimulated by television; this causes them to "shut down" and become extremely passive. We will summarize the research on television viewing with respect to each of these assertions.

1) Children do spend large amounts of time with television, but probably not as much as popularly represented. Since most figures derive either from parents' global estimates or from commercial ratings services, overestimates appear to be common. Time with TV is apparently about 60 to 80 percent of that popularly reported. About two thirds of the time school age children spend with television is spent actually watching it, with the rest of the time spent in a variety of other activities.

2) Children's attention to television is quite variable. Looking away from the TV is quite common, and extended periods of looking as long as several minutes in duration are relatively rare. Listening to TV appears to occur primarily at the same time as looking, although this linkage gets weaker with age, so that older children are more likely to listen when not looking. Although formal features do act to get and hold attention, the

most effective features are auditory rather than visual. The evidence indicates that children learn that particular features signal comprehensible and entertaining content and thus pay attention when those features occur. Children are quite sensitive to content and pay little attention to television when the content is not comprehensible, regardless of the formal features. In general, children appear to learn strategies of attention which are in service to comprehension and which allow activities concurrent with TV viewing.

3) Preschool children comprehend short television segments in a connected and coherent fashion. Inferential activities are quite common. Preschool and early elementary school children, on the other hand, have considerably more difficulty comprehending full length dramatic programs. They form fewer essential inferences and are more likely to misinterpret programs based on their own limited experiences. Older elementary school children who have by and large mastered comprehension of television perceive the medium as being relatively undemanding in a cognitive sense, and as a consequence, they often devote less mental effort to comprehending television programs than they do to text. This may be a consequence of the perceived entertainment vs. information functions of TV as compared to reading. Since "reflection" during TV viewing has never been defined in an operational scientific fashion, it is difficult to determine whether it occurs. Looks away from TV are frequent, during which thinking about the program may occur, and reflective conversations concerning ongoing TV content are common between siblings watching television together.

4) There has been relatively little effort to determine whether television is over-stimulating and creates passive withdrawal. Most research indicates viewers tend to be relaxed when with television, although television can cause excitement and arousal. It has not been demonstrated whether these characteristics of TV are unique to it as a medium. Furthermore, since viewers frequently look away from TV, there is in general no compelling evidence to support the assertion that they become overstimulated.

Some researchers who have intensively examined young children's attention to and comprehension of television have been impressed by the findings of children's learned and strategic cognitive processing of TV. Television viewing is, in many ways, as cognitively active as reading, and many find this surprising. This perspective stands in rather bold contrast to characterizations of TV viewing as cognitively passive.

Rather than calling TV viewing passive, therefore, researchers have used the term "active" (e.g., Anderson & Lorch, 1983; Huston & Wright, 1983). Unfortunately, active and passive are relative terms without precise technical meaning, and the use of either term in a scientific context can lead to misinterpretation. For example, television viewing probably does not require many of the self-generated cognitive processes required by writing; as receptive cognition, it is likely different in many ways from productive cognition. The terms "active" or "passive", however, do not convey the relevant differences, so little information is provided by using such terms. Television viewing is a complex cognitive activity in its own right and deserves consideration as such.

Cognitive Effects of TV Viewing

Common assertions about the cognitive effects of television generally stem from beliefs about the nature of television viewing itself. The assumed enthrallment of attention by rapidly paced formal features presumably reduces attentional abilities. The assumption that comprehension by young children is a passive storage of disconnected images enables the belief that television reduces the ability to infer and reflect. These hypotheses involve direct effects of TV viewing. Other assertions about television imply indirect effects. Chief among indirect effects is the belief that the time spent with television displaces activities which are valuable for cognitive development. For example, a common belief is that television viewing displaces reading, with the indirect effect of reducing reading ability due to lack of practice.

Consideration of the information we have already presented casts doubt on many of these common beliefs. Since TV is not obviously enthralling of attention, one may question its effects on attentional abilities. As inferential activity occurs during TV viewing, it is not clear that inferential ability would be adversely affected. Because activities concurrent with TV viewing are common, it is not assured that reading is displaced. Knowing about television viewing helps in the consideration of questions about television's effects, rendering some less likely to be true, but raising the possibility of others. For example, since children develop strategies for looking at and listening to television, is it possible that these strategies transfer to academic situations and interfere with the acquisition of attentional strategies more appropriate to school situations?

In this section we will examine the research literature on the cognitive effects of television viewing. Unfortunately, the literature is sparse, so that many possible cognitive effects of television are not addressed. Consequently, we will suggest some possible effects and the mechanisms by which they might occur. Where the literature indicates an effect may exist, we will also consider possible direct and indirect mechanisms that might be responsible. Due to the scattered and inconsistent nature of the research literature, this section of the paper is considerably more speculative than the section on television viewing itself.

We will first consider the literature on displacement in order to determine what potentially valuable cognitive activities are replaced by television viewing. We will then briefly discuss effects on children's knowledge bases. Our major concern, however, will be with effects on cognitive processes, an area where some research and considerable speculation has been published. Effects on task perseverance and creativity will then be separately considered. Finally, we will examine the effects of television viewing on reading.

Displacement

One of the most plausible hypotheses about the consequences of television viewing is that it displaces other activities. The hypothesis may be found in most writings on television's cognitive effects and is usually stated in the negative: Television viewing displaces activities which may be valuable for cognitive development. Interestingly, the hypothesis is rarely entertained that television viewing may displace activities that are *less* cognitively valuable than television viewing itself.

In order to make a case for negative displacement effects on cognitive development,

two conditions must be satisfied: 1) There must be a demonstration that displacement of a particular activity actually occurs. 2) There must be a demonstration that the displaced activity is itself more valuable for cognitive development than television viewing. These conditions are not easily met.

Research relevant to displacement is of three types: studies of children's time use before and after television comes to a locale, correlational studies of children's time use relative to the amount of time they spend with television, and experimental reduction of TV viewing time with an examination of the activities that then fill in the available time. In all three types of studies measurement problems exist in assessing time use. It is not yet clear what measurement technique is the most valid assessment of time spent in activities other than TV viewing.

Studies of children's time use before and after the arrival of television seem in many ways to be the most "pure" assessments of displacement effects. Unfortunately such studies are limited in a number of important and largely unavoidable ways. First, the locales of these studies have usually been relatively isolated small towns or rural areas in a number of different countries and with a number of specific homogeneous ethnic subgroups. The very nature of the studies, furthermore, limits them to a particular narrow historical time period; they are not even in principle subject to replication. Interpretation of these studies, therefore, must be approached very cautiously. For example, if a study were to demonstrate that children in the Rockies in the 1950's listened to the radio more before television than they did after its arrival, it is unclear to what extent we could generalize that finding to say, New York city children of the same era. Furthermore, since radio itself has changed in format since then, it is unclear whether children would engage in more radio listening if TV were not available today. The results may be limited to a particular time and place, more so than other research which is at least open to replication so that generalizability can be assessed.

With these considerations in mind, there is in fact some consistency of findings across studies of the arrival of television (cf, Hornik, 1981). In school-age children television viewing primarily displaced other entertainment activities: radio listening, movie attendance, and comic book reading. With some exceptions (e.g., in Japan, Furu, 1971) only minor displacement of reading, homework, and other activities has been noted (Brown, Cramond & Wilde, 1974; Campbell, 1962; Himmelweit, Oppenheim & Vince, 1958; Murray & Kippax, 1978; Schramm, Lyle & Parker, 1961). Several studies (Brown et al., 1974; Murray & Kippax, 1978; Williams & Handford, 1986) note a decline in organized outdoor activities after the onset of television.

The onset of television primarily replaces consumption of other entertainment media with small additional effects on reading and homework. It is an open question whether the displaced entertainment media in the particular times and places of these studies were more intellectually stimulating than television. Differences between movies and television were probably not great enough to produce a cognitive impact. Comic book reading may have provided reading practice that some children would otherwise not get (cf, Hornik, 1981), but there is no evidence that comic books generally facilitate reading or other cognitive abilities; there have been many claims to the contrary (cf, Gilber, 1986). There are some arguments that radio drama may be more stimulating to inferential activity and imagination than television (Greenfield & Beagles-Roos, in press), but empirical support is presently mixed (see imagination and creativity section below). It is possible that radio enhances listening skills, and that these skills, in turn, may be related to reading acquisition (see discussion on reading, below). In general, however, media comparisons are

notoriously difficult to unambiguously achieve, (cf, Meringoff, Vibbert, Char, Fernie, Banker & Gardner, 1983) and claims of differences have not been convincing (Clark, 1983). Besides media consumption, attendance at organized outdoor activities, especially sports participation, is reduced by the arrival of TV. It is not clear what cognitive skills are lost by this displacement, although it is certainly possible that valuable social and athletic skills are less developed.

The second type of displacement study considers TV viewing in places where television is already well established as an entertainment medium. These studies generally compare time spent with television and time spent with other activities. The major problem in interpreting these studies, as pointed out by Hornik (1981), is that "...when both watching and other activities are the result of individual choice, [a negative correlation] will not tell us anything about what would happen if current watching behavior was forced to change. An individual who, by choice, watches 4 hours of television per day and is forced to reduce watching to 2 hours per day, will not do the same activities in the excess time as someone currently choosing to watch 2 hours a day" (p. 200). Individuals presumably choose television viewing in preference to a number of other possible activities; less viewing would not necessarily mean a choice of activities more cognitively valuable than watching TV.

Given these cautions on interpretation, there are, in any case, few comprehensive time use studies of children. Hornik (1981) cited a survey (Survey Views TV, Homework Habits, 1978) indicating a negative correlation between hours of television watching and hours of homework. Walberg's (1984) synthesis of 3000 educational productivity studies and his meta-analysis of studies addressing the effectiveness of homework (Paschal, Weinstein, & Walberg, 1984) indicated that homework, especially graded homework, had a strong and significant positive relationship with school learning. In fact it had 3 times the effect of SES. Noting the large number of hours that high school students spent watching television and the few hours spent doing homework weekly, Walberg suggested that television may displace homework (Paschal et al., 1984; Walberg, 1984; Walberg and Tsai, 1985). As Hornik (1981) points out, however, it is impossible to determine the cause and effect relationship here: Those children who are assigned less homework may as a consequence have more free time and thus watch more television. In fact, some educational researchers suggest that the small number of hours spent doing homework by today's students reflects changes in schools' curricula that coincide with the time period when television became pervasive in our society (see D'Angelo, 1983, for a summary of this argument). At any rate there is no conclusive evidence that television viewing displaces homework.

Williams and Boyes (1986), in their study of children from three small western Canadian towns, report a small negative correlation between TV use and radio listening, and a small positive correlation with comic book reading. Medrich et al. (1982) in a study of Oakland, California children, found that light viewers were more likely than heavy viewers to engage in organized fine arts or sports programs. They found little difference in overall reading although light viewers were more likely to read every day than heavy viewers. Timmer et al. (1985), in a national U.S. study, found that light viewers spent more time than heavy viewers in personal care activities and in church. Neuman (in press) in a reanalysis of eight state educational assessment studies as well as data from the 1984 National Assessment of Educational Progress found little evidence that television displaces reading or homework. Similarly, Anderson, Wilson, and Fielding (1986) found no significant relationship between leisure time reading and TV viewing in a detailed study carried out in Illinois. Again, as with studies of the arrival of television, there is no

convincing evidence of a tradeoff between time spent television viewing and time spent in apparently valuable cognitive activities such as reading. Hornik (1981) put it succinctly: "There was not much reading before television, and there is not much now" (p. 202).

The third approach to examining displacement involves experimentally reducing TV viewing. The first of two published studies taking this approach was reported by Gadberry (1980). Fifteen 6-year-old middle class children's TV viewing was restricted by their parents to "the lowest level comfortable for the family". Compared to a control group, the restricted group viewed half as much for a 6-week period. Of interest here is what activities filled in the now available time, about 6 hours per week. The only category to show a significant increase was "reading time", which increased from 48 minutes a day to 66 minutes a day. The nature of reading time was not clearly defined (e.g., being read to, comic book reading, etc.), and it should be pointed out that the amount of reading time by these children prior to TV restriction was about seven times greater than the figures reported for a national sample by Timmer et al. (1985). A tentative conclusion from this small scale study is that reducing TV viewing time in children who already read much more than average can further increase reading.

The second reduced viewing study (Wolfe, Mendes & Factor, 1984) concerned 5 children aged 8 to 12 years from three working class families. The children were all considered by their parents to be heavy TV viewers and the parents indicated that they had been unsuccessful in reducing their children's viewing by reminders and criticism. The reduction in TV viewing was accomplished over a 3-month period by a system of token rewards. Reading (of all kinds), TV viewing, and homework were monitored via time-use diaries. These diaries revealed that the amount of TV viewing was reduced from an average of 21 hours per week to about 10 hours per week. Two out of the five children increased their homework time, from nearly zero to several hours a week, but this increase remained in effect for only about a month of the 3-month reduced viewing period. All 5 children increased their reading time to as much as 10 hours a week, but again this effect dropped back to baseline levels after about 6 weeks into the reduced viewing period. Without providing data, Wolfe et al. (1984) suggest that most of the time released from television viewing was taken up by "appropriate recreational activities" other than reading. Taken together, then, the two very small experimental studies indicate that at least a short term increase in reading may be found when amount of TV viewing is cut in half. It is also clear from these studies that most of the time made available by restricting TV is devoted to recreational activities other than reading.

A problem with interpreting displacement claims is that some activities are not mutually exclusive with TV viewing. While cinema attendance and outdoor sports certainly cannot be engaged in while with TV, and radio listening is unlikely to occur during TV viewing, a variety of other activities can be timeshared with television. These timeshared activities include reading, doing homework, and a variety of other potentially intellectually valuable activities. All investigations which have involved extensive observation of TV viewing in homes by means of film or video have reported that these activities occur, but none have provided quantitative estimates of their frequency (Allen, 1965; Anderson & Field, in press; Bechtel et al., 1972). Williams and Boyes (1986) have argued that reading and homework timeshared with television must be reduced in quality because of the distraction provided by the TV. There is no direct evidence concerning the quality of reading and homework done in the presence of television, although a number of investigations using auditory backgrounds find facilitation of task performance under some conditions and interference under others (e.g., Higgins & Turnure, 1984; Von Wright & Nurmi, 1979).

Patton, Stinard, and Routh (1983) addressed the issue of homework timeshared with TV, radio, or recorded music through a survey of 387 grade 5 through grade 9 students in Cedar Rapids, Iowa. The students were questioned on four major topics: amount of time spent on homework, actual and preferred home study conditions, judgement of optimal study conditions, and rated effect of TV, radio, and recorded music on studying of different kinds of material. The children reported an average of 4.2 hours per week on homework, with most (1.8 hours) devoted to mathematics and the least (.7 hours) devoted to reading. The setting preferred by children for doing homework varied primarily by subject matter, with quiet settings preferred for reading and nonquiet settings preferred for mathematics. Overwhelmingly, the children's preferred study conditions were those they actually studied in. Twenty-two percent of the elementary school students reported reading with television as a background and 37 percent reported doing mathematics with TV as a background. The figures for studying under quiet conditions were 47 percent for reading and 22 percent for mathematics. Junior high school students were more likely to study in either quiet conditions or with music as a background; 11 percent reported reading with TV, and 23 percent reported doing mathematics with TV. Background music was rated as more helpful to studying by better readers, whereas TV was rated as slightly bothersome to studying by all but poor readers.

Patton et al. (1983) interpret their findings as indicating that children tend to choose a study environment appropriate to the task. They also suggest the possibility that music or television may actually facilitate homework through motivational means: "...studying might involve more than doing one's best work (e.g., students might be more concerned with persevering through a lengthy assignment to produce a finished product); and it is possible then, while environmental distractors have perceivable, adverse effects, they might be beneficial in other respects (e.g., by increasing the length of time a student can or will work)" (p. 285).

In sum, there is no consistent or strong evidence that television viewing displaces valuable cognitive activities. The major activities that are displaced, radio listening, comic book reading, and movie attendance, have not been demonstrated to be more generally intellectually valuable than TV viewing. When the meager evidence concerning experimental reduction of TV viewing is considered, we find a slight increase in reading (possibly comic book reading), but there is no evidence that this increase is maintained beyond about six weeks. Interestingly, there have been no studies which have involved experimental increases in homework or in reading to find out if TV viewing would be spontaneously reduced. Also, none of the investigations of displacement have pointed out that there are enormous seasonal fluctuations in amount of time spent with television; in general, TV viewing is reduced in better weather. It is not clear what activities displace TV viewing in good weather, but outdoor play is a likely candidate.

We believe future research which hypothesizes displacement as a mechanism underlying television's effects should take into consideration the question of why children spend time with television. If the children and their families are viewed as active agents in their choice of activities, the perspective changes: Rather than television displacing other activities, television viewing is chosen over or concurrent with other activities. These choices very likely stem from a constellation of factors including parent education and occupation, attitudes toward television, attitudes toward reading, ethnic cultural background, available leisure time, weather, and the perceived availability of alternatives. These factors probably determine the totality of cognitively valuable activities engaged in by children more than does the availability of television.

Effects of Television on Knowledge

Depending on which figures one believes, American children average between 12 and 25 hours a week with TV. Even accepting the lower figure, children are exposed to a large amount of television-presented information: images, language, fantasies, facts, fiction, and action. Research on comprehension and memory for television programs indicates that while young children may not necessarily form a coherent understanding of complex programs, they nearly always remember some settings, actions, characters, and the like. Older children apparently remember far more. It is certainly the case that a great deal of information is retained about specific programs (educational or otherwise), commercials, and characters; witness the popularity of trivia questions about television. Information of more general relevance is presumably retained as well.

Information absorbed from television becomes part of the child's store of knowledge and, according to contemporary cognitive research and theory, the general knowledge base acquired by the child plays a central role in cognitive development. In this section we will examine what little is known about the contribution of entertainment television to the content and structure of children's knowledge. There is little question that television which is specifically designed to convey knowledge does so (e.g., Bryant, Alexander & Brown, 1983).

Unfortunately, with the exception of one research group, there has been little effort to systematically categorize and quantify the content of entertainment television. Consistent with the predominance of concern with the effects of television on social behavior, content analyses have concentrated on the numbers and types of television's characters, and on their social behavior. The analyses done by the University of Pennsylvania research group associated with George Gerbner are the largest and most systematic efforts at categorizing and quantifying content (cf, Gerbner and Gross, 1980; Gerbner, Morgan & Signorielli, 1982). Their research, however, has primarily focused on what might be considered background, setting, or incidental information about characters and character behaviors with an emphasis on hypothesized influences on viewers' constructions of social reality. Since this kind of information is generally the least likely to be retained by viewers (cf, Collins, 1983; Gibbons et al., 1986; Lorch et al., 1987; Meadowcroft & Reeves, 1985), one would expect that the hypothesized effects of this background content are generally present but weak. This appears to be the case (Hawkins & Pingree, 1982).

Relevant to present concerns, what is generally missing is an inventory of explicit declarative and procedural information presented on television which is relevant to cognitive development and academic achievement. The information should come from those programs most watched by children, and should be relevant to the physical and earth sciences, the life sciences and health, technology, mathematics, the social sciences, law, history, current events, literature, and language. The information, furthermore, should be categorized as to whether it is essentially procedural (potentially leading to knowledge of how to do things or how things work), or declarative (expressing a fact or a relationship). Finally, the information should be categorized, if possible, as to whether it is essentially accurate or whether it is false or fictional.

Without such a systematic content analysis, it is very difficult to know what the information content of television is to American children. Although most entertainment television watched by children is certainly not dense with academically relevant informa-

tion, the appropriate question concerns cumulative exposure to such information. This may be especially true given Greenberg's (1974) (as reviewed by Noble (1983)) finding that nine to fifteen-year-olds' most commonly reported reason for liking to watch TV was to learn about things and themselves. In any case, children may be exposed to a great deal of some kinds of information and very little of other kinds. They also may be exposed to a great deal of academically relevant but false (fictional) information. Examples of the latter would be misrepresentations of physical principles in cartoons and science fiction dramas or of normal legal procedures of criminal trials in crime dramas.

Most of what children watch on television is fiction. Nevertheless, within fiction, there is likely to be some academically relevant information which may be either accurate or inaccurate. We know from Noble (1983) that school-age children can and do learn academically relevant factual information from self-elected viewing of entertainment programming as well as, of course, from educational programming (Bryant, Alexander & Brown, 1983). An important question not yet dealt with in research, however, is the way in which children, if they recognize a program as fiction, enter information from that program into their knowledge base. Do the children "tag" all or some of the information as fictional? If so, is that information unlikely to be retrieved when it is academically relevant to do so?

The issue is central to understanding the way in which information taken from television is likely to be used by the child. If fictionalized information is tagged as academically irrelevant, then the information acquired from fictional television is academically useless. If it is not tagged, then there is some danger that academically relevant but inaccurate information becomes part of the child's general knowledge base. It is our intuition that literate adults have sophisticated techniques for tagging information gleaned from fiction as essentially accurate or as not accurate (for example, background events and settings in a historical novel are likely to be accepted as essentially accurate). Note that this question is not the same as the question of whether a child perceives a television program as essentially realistic or nonrealistic (cf, Dorr, 1983); the question is, given that the child makes this distinction, what is the fate of academically relevant information?

Lacking an inventory of academically relevant content in programs watched by children, and lacking knowledge of how children encode that information, it is not surprising that little is known about the influence of television on knowledge. In their study of television's arrival, Himmelweit et al. (1958) found that English children with access to television showed better knowledge of some topics than children without access to television, but these effects appeared to be restricted to younger, less intelligent children. Lemish and Rice (1986) observed a good deal of vocabulary teaching by parents to their infants and toddlers in the context of television viewing, suggesting that vocabulary may be added to the knowledge base. This observation was supported in a laboratory study by Rice and Woodsmall (in press) who demonstrated that preschoolers acquire vocabulary from TV, especially object and attribute words. Schramm et al. (1961) found that children in a town with television did better in general vocabulary than children in a town without television. In tests of general knowledge, however, there were no overall differences between towns. Harrison and Williams (1986), in their comparisons of Canadian towns with and without television, found little consistent evidence of an advantage in vocabulary for television towns. Thus, while television may provide some advantage in increasing children's vocabulary, the results are not entirely consistent.

In areas where television is well established, there is generally a negative correlation between vocabulary and TV exposure, except possibly for low intelligence children where the relationship tends to be positive (Morgan & Gross, 1982). It is difficult to interpret correlational findings relating television viewing and knowledge in general because TV exposure is inversely related to ability; brighter children usually have more general knowledge and especially larger vocabularies (Sternberg, 1985). Brighter children may choose to watch less television for a variety of reasons, producing a negative correlation between vocabulary and TV viewing.

One study that could be interpreted as supportive of this possibility is that reported by Selnow and Bettinghaus (1982). They found an interesting relationship underlying the generally small but significantly negative correlation between hours of television viewing and linguistic competency, namely, preschool children who "...displayed less sophisticated language tended to view more language-poor programs than other children" (p.477), and those children who had more sophisticated linguistic productions watched programs that modeled more sophisticated language. Thus, brighter children may not only be viewing less television, but the programs they view may be different and more in line with their intellectual abilities. In this regard, Harrison and Williams (1986) report an interesting result: Children who had higher vocabulary scores *before* television arrived, tended to be light TV viewers later. This finding suggests that observed negative correlations between vocabulary and TV viewing (cf, Morgan & Gross, 1982) are in fact best interpreted as higher vocabulary children choosing to watch less television, rather than television stunting vocabulary acquisition.

In sum, due to a general lack of relevant research, there is little evidence that children's academically relevant knowledge base is influenced by entertainment television. There is mixed evidence that children acquire vocabulary. Since most vocabulary is probably learned from context, not from explicit teaching (Sternberg, 1985), it is an interesting conjecture that the audiovisual context of television may be helpful in vocabulary acquisition. In any case, the issue of television's effects on children's knowledge base is of considerable importance and we believe is an important problem for future investigation.

Effects on Cognitive Processes: Cinematic Codes

By "cognitive process" we refer to a mental activity which operates on and transforms a memory representation or a perception. While there are a large number of candidate cognitive processes which can in principle be affected by television, only a few have received attention from researchers.

One means by which television might influence cognitive development is through the activation and cultivation of particular cognitive processes. As we saw in the section on comprehension, television makes use of a set of conventional cinematic codes, including montage, intended to convey meaning via their similarity to, or by calling upon specific cognitive processes. That is, they are meant to represent or demand the transformation or manipulation of memories and perceptions. For example, the zoom is a camera technique by which the viewer's attention is gradually focused on some element or subset of elements present in the whole. If the zoom technique is frequently used in children's programs, one hypothesis is that viewing these programs would lead to the development or improvement of an ability to relate detail to whole. The ability to generate inferences, or integrate sequences, on the other hand, might be expected to result from frequent scene

changes that imply a change in time or place, or that imply the occurrence of particular events. Finally, cinematic techniques that are intended to convey the perspective of a character might be capable of enhancing the development of perspective taking abilities in children.

Little research has been conducted investigating the extent to which programs watched by children consist of such cinematic codes, but preliminary content analyses indicate that they occur with great frequency (Anderson & Smith, 1984; Huston et al., 1981). Nor has it been established that cognitive processes are affected by cinematic codes under normal viewing conditions. Rather, evidence suggests that in principle, television and film *could* lead to the internalization of filmic codes and alterations of cognitive processes (Rovet, 1983; Salomon, 1974, 1979).

We will begin by reviewing the evidence which pertains to filmic presentations of transformations, that is, the explicit modeling of specific cognitive processes. In three different experiments, Salomon (1974) exposed eighth-grade Israeli children of differing skill levels to media presentations that varied in the degree to which a specific cognitive process was completely modeled.

The first experiment used a film modeling the relation of detail to the whole through the use of camera zooms. A group of children exposed to this film improved in their ability to list details contained in a complex visual display. In fact, performance was equivalent to that induced by practicing the cue- attendance task itself. Furthermore, performance was significantly better than that of a group exposed only to the beginning and end states of the attention-focusing process. This group, in turn, performed better than a group receiving no training. From this we might conclude that the ability to focus one's attention on detail is better served by training that entails either the explicit modeling of the cognitive process involved in doing the task or direct practice of the task itself, than it is by training that simply shows the beginning and end states of that cognitive process.

In support of such an interpretation is the fact that degree of improvement in a particular training condition was modified by level of cue-attendance ability, as measured in the pretest. Children who scored higher on the pretest benefitted more from practicing the task than from seeing the transformation modeled. On the other hand, children who scored lower in benefitted more from observing the processes involved in noting details than they did from practicing this task. What is most interesting for present purposes is that training which involved presenting the cinematic analogue of a cognitive process was sufficient to induce at least short term changes in attention focusing performance. The somewhat incongruent finding that explicit modeling may have disrupted performance of the better skilled children might best be explained by the fact that the zooms were randomly sequenced. Rather than moving from one subsection of Breughel's painting (the complex visual stimulus in this case) to an adjacent one, the zooms followed one another in what might have appeared a "willy-nilly" fashion to the child who would normally proceed more systematically (eighth graders have systematic visual scanning strategies, Vurpillot, 1968). Nevertheless it *was* demonstrated that eighth graders could improve their cue-attendance performance after viewing. It seems that the eighth-grade children had in fact internalized the zoom technique.

The evidence to support this phenomenon may appear to be weakened by the fact that the second experiment did not entirely replicate the first. There were no significant differences between groups in performance on the post-test. This was perhaps due to

insufficient training or a lack of power to detect group differences. Training sessions in the second experiment involved only a small fraction of the number of transformations used in the first experiment. This may indicate that a substantial amount of exposure (at least within a single viewing session) is required to produce the phenomenon.

The third experiment, however, verified filmic internalization. In this case the cognitive operation modeled was the laying out, or unfolding, of an object from three dimensions to two. Exposure to a film that demonstrated the entire process, from the unfolding of the first to the last side of the object, led to performance that was significantly better than seeing the three dimensional object followed by its representation in two dimensions without the intervening unfolding process. Together, these experiments suggest that when cinematic codes are used in films specifically designed to teach their cognitive process analogues, children may internalize the cinematic codes, thereby increasing their repertoire of cognitive skills.

Rovet (1983) extended the findings of Salomon (1974) to another cognitive process. Using a similar methodology, Rovet examined whether mental rotation of objects in space could be taught when conveyed through film. Third grade Canadian children were assigned to one of three film conditions, or to a no training condition, or to a condition in which the child was taught to physically manipulate objects when trying to solve problems of spatial rotation. The problem to be solved was whether two objects in different orientations shared the same shape. The film conditions varied in the degree to which the rotation process required to solve this problem was explicitly demonstrated. Children who had either witnessed the entire transformation process via film or who had been taught to physically rotate the objects to solve this problem, demonstrated equivalent performance both immediately and two weeks later. Their performance was significantly better than that of children who had seen only the beginning and end of the rotation process on film. Yet even this reduced degree of explicitness was superior to modeling only the beginning and end states, which was completely ineffective. These results support those reported by Salomon (1974). Children's ability to perform specific cognitive operations *can* be improved by observing films that explicitly present beginning and end states and the intervening transformations.

To review, we have evidence indicating that a child's level of competence in focusing attention or mentally transforming representations can be improved by instructional films that use cinematic codes to model these processes. This effect is perhaps achieved by internalization of the codes themselves. Furthermore, the usefulness of the cinematic codes as models depends on the child's level of competence in the analogue cognitive process prior to viewing training films. For skilled children, practice in the skills themselves may improve test performance more than training via cinematic codes. Verification of this result is required and could be achieved by replicating the first experiment of Salomon (1974) using a stimulus film that does not model a random search pattern. If skilled children still benefitted more from practice than from observing this film, it may be that the power of this class of cinematic codes is limited by some sort of ceiling. Alternatively, improvement beyond a certain level may require large amounts of exposure to the technique.

For the class of cinematic codes that call upon, as opposed to model, particular cognitive processes, children more skilled in these processes are better at comprehending films which use those codes than less skilled children (Salomon & Cohen, 1977, see the earlier description in the section on comprehension of montage). This finding implies that when this class of cinematic codes is used to convey meaning in a narrative, the codes do

in fact call upon specific cognitive processes, e.g., inferencing and integration of sequential information.

Yet, even if some codes can be internalized, these studies have not demonstrated whether, under conditions of normal home viewing, there is any direct effect on specific cognitive processes. Attempting to examine this issue, Salomon (1979) reported a longitudinal study involving preschoolers, second graders, and third graders in Israel. The purpose of the study was to determine the impact of six months of *Sesame Street* viewing on the cognitive abilities of children who had little previous exposure to the cinematic codes commonly seen in *Sesame Street*. Television exposure was measured on several occasions over the broadcast season, and consisted of three dimensions: amount of time spent viewing, enjoyment, and program comprehension. Viewing declined among the school aged children who had initially been the heaviest viewers. Lower class preschoolers increased their viewing, and by season's end they were viewing more than the older middle-class children. Enjoyment measures showed the same pattern. It may have taken a while for Israeli children to decipher the cinematic codes of *Sesame Street*, since correlations between amount of viewing and comprehension consistently increased over the broadcast season. Furthermore, mastery of these codes may explain the decreased enjoyment and viewing by older children, an age group for which the program was not designed. Younger children's increased viewing, comprehension, and enjoyment may have arisen in part from mastering the same codes (cf, Anderson & Lorch, 1983; Huston & Wright, 1983).

What were the consequences of exposure to these presumably unfamiliar cinematic codes? The pattern of results was different for preschoolers and school-aged children. Preschool children's amount of viewing was correlated with neither field independence (finding a given object embedded in a complex background) nor picture-ordering ability, the two non-content skills on which they were tested. School-aged children, on the other hand, showed small but significant effects of program exposure on several cognitive skills not explicitly taught by the program's content, but which presumably were cultivated by the program's filmic codes. These skills included the ability to predict and recognize another person's perspective, relating a detail to the whole of which it is a part, field independence, integrating a series of pictures into a sensible sequence, and distinguishing single items from the compounds of which they are a part. Cross- lagged panel correlations indicated that levels of the kinds of knowledge that are the educational goals of *Sesame Street* did not predict mastery of the non-content cognitive skills. Rather, competence in these non-content skills moderately predicted acquisition of the knowledge explicitly taught by *Sesame Street*. This suggests that learning the codes increased skills which in turn allowed better comprehension of the program's content. It is not clear, however, why these effects were not also found in preschoolers.

In a further study, Salomon (1979) showed *Sesame Street* to Israeli second graders for eight days in school. A comparison group was shown "adventure and nature" films. Using the same measures employed in the previous study, the *Sesame Street* viewers were found to have better performance than the comparison group.

Salomon (1979) interprets the results of these studies as supporting the hypothesis that, in the service of learning the explicit lessons of *Sesame Street*, children learn to apprehend the meanings intended by cinematic codes. In doing so, cognitive skills themselves are activated and learned. While the data do not contradict such an interpretation, caution should be exercised before it is adopted. First, the demonstrated effects are short-term and small, and limited to older children. Does this mean that

children must already be familiar with the content conveyed by cinematic codes for them to have an effect? Second, it is not clear that programs without educational intent would produce the same effects. Do children who know that they will be repeatedly questioned and tested about an educational program modify their viewing habits at home as they did in studies by Field and Anderson (1985) and Salomon and Leigh (1984)? Could this more attentive processing account for the effects? Third, the actual cinematic codes used in *Sesame Street*, their relative frequency of occurrence, and their importance to comprehension of the content was not established. It was simply assumed that they were different than, for example, adventure and nature films. Clearly this limits our ability to directly relate differences in cognitive skills to the formats and cinematic codes used in *Sesame Street* programs.

In summary, our knowledge about whether and how exposure to television's unique cinematic techniques affects specific cognitive abilities is limited. Only a small number of studies have investigated television's effects at this level and those are methodologically limited. Nevertheless, it appears that, for some children, television programs which make use of specific cinematic techniques may facilitate the acquisition of such specific cognitive skills as attention-focusing, spatially transforming mental representations, inference making, and perspective taking.

Clearly, more research is required in this area to determine the robustness and generalizability of these initial findings. The research should address the kinds and frequency of specific cinematic techniques that are used in children's programs; and determine whether they engender specific cognitive processes beyond those examined thus far. Once cinematic codes are readily understood, do they continue to exert a further influence on development, or is this a threshold phenomenon? Until the initial work is replicated and extended with improved methodologies, we will not know with certainty the long-term effects of exposure to entertainment television's cinematic techniques.

Effects on Spatial Abilities

Many assertions about the effects of television's formats are based on a very general level of analysis. That is, these assertions rest on characteristics common to most or all of television's codes, rather than any characteristic unique to one. For example, it has been asserted that once television's symbol system has been mastered, it enables apprehension of information without the need for much recoding or elaboration. This leads to the perceived ease of understanding information presented by the medium which may in turn transfer to interactions with other media (Salomon, 1983b). Assertions about television's effects that rest on the notion that television is primarily a "visual medium" also fall into this more general level of analysis. For instance, television, as a visual medium, may improve visuospatial abilities. Other common assertions are that television does not require inferencing or elaboration which are necessary for the development of imaginative and creative abilities, or television provides children with concrete visual images of fantasy objects and action, obviating the need for children to generate images for themselves. These would lead to reduced fantasy play and creativity. This section and the next will examine these possibilities in more detail.

We begin with spatial abilities. Most of the evidence consists of correlations scattered throughout the literature on television and development. The majority of the reports have as their primary focus the relationship of television to an even more global measure of ability, namely IQ. The closest approximation to studies explicitly designed to investigate television's effects on spatial abilities are those discussed above in the section

on television's cinematic codes. Clearly, cognitive operations such as spatial rotations (Rovet, 1983) and relating detail to whole (Salomon, 1974, Salomon and Cohen, 1977, Salomon, 1979) are related to spatial abilities. To the extent then, that componential skills of spatial abilities are improved, one might expect the more general class of skills to be likewise affected. However, as we saw in the section above, the conclusions we can draw from the available evidence are tenuous, and can hardly be generalized to a comprehensive set of spatial skills.

Moving to a more general level of analysis, the information available and conclusions that can be drawn are even more tenuous. In their investigation of the arrival of television in a rural Canadian town, Harrison and Williams (1986) used the WISC Block Design subtest as an index of spatial abilities. This test required subjects to manipulate blocks such that together their surface matched the model pattern provided for them. During Phase I of the study, before television arrived in the town designated as Notel, fourth and seventh graders were tested and the results were compared to those from Unitel, which had one channel of television, and Multitel, which had four channels. Phase II testing included sixth and ninth graders as well, enabling longitudinal analyses. Overall, Harrison and Williams (1986) found little relationship between television exposure and spatial abilities. Cross-sectional analyses yielded no differences between towns. Likewise, longitudinal analyses did not yield any significant differences due to town or phase.

A study reported by Lonner, Thorndike, Forbes, and Ashworth (1985) took advantage of a situation similar to that available to Harrison and Williams (1986). In this case, television was introduced to rural Alaskan towns of either Eskimo or the Tlingit and Haida cultures. The aim of the study was to investigate whether exposure to television had an acculturating effect on the relative strengths of different kinds of cognitive skills that they believed characterized these groups. More specifically, the more traditional Eskimo (Inupiat) towns were believed to "...excel in the visual domain of cognitive processes, probably at the expense of the verbal domain of abilities (when judged against the background of a typical Western upbringing)" (Lonner et al., 1985, pp360-361). The more acculturated Haida and Tlingit towns were expected to be less "visually dominant" prior to television's arrival. Regression analyses were used to determine whether television exposure significantly contributed to third through eighth graders' scores on the Children's Embedded Figures Test (locate the simple object embedded in a more complex figure), the Raven Standard Progressive Matrices test (complete the matrix based on properties of existing elements), and Kohs Block test (similar to the WISC Block Design test).

Television made very small, and usually nonsignificant, unique contributions to variance in test scores. The pattern of relationships between television and test performance varied complexly as a function of test, sex, and culture (i.e. location). Since the pattern of results does not yield itself to any clear explanation in terms of the development of spatial abilities, and since the results appeared to change not only in levels of significance but in pattern over different years, little can be concluded from this study.

An experimental study was reported in Gadberry, (1980). As described earlier, six-year-old children were assigned to either a TV viewing reduction condition or a control condition. Three months prior to television restriction children were administered the Wechsler Preschool and Primary Scale of Intelligence. This includes a Performance scale that is distinguished from the verbal scale and includes the ability to "systematically

search for visual details" (Gadberry, 1980, p. 55). Analysis of the WPPSI Performance scale after the six week intervention revealed greater improvement in test performance for the television restricted group. It is interesting that the direction of this effect is contrary to that predicted by the cinematic codes work and by the hypotheses based on television's visual nature. It is possible that the activities the children in the restricted group engaged in accelerated the development of their ability to search for visual details to a greater degree than the same time spent with television would have. On the other hand, children in the restricted group tended to watch educational programs such as *Sesame Street* to the exclusion of commercial fare. As Gadberry points out, these programs may encourage the child to focus on details that distinguish between letters as well as other visual discriminations. This interpretation is consistent with the results of Salomon's investigations described above.

If restricting television leads to greater attention when viewing does occur, then perhaps the content or format of educational programs is more effective in changing spatial skills. Unfortunately, we do not know if attention to the television does increase when its availability is limited. In any case, Gadberry cautions that the pattern of relatively greater improvement on the part of children who watched less may have been an artifact of initially higher (perhaps ceiling) performance by the non-restricted group. Once again, we are left feeling intrigued but unsatisfied. While there are hints that television viewing is generally related to spatial abilities, it is not even clear whether the relationship is positive, negative, or important.

One reason for such disappointing progress may be the level of analysis used in these studies. As Harrison and Williams (1986) point out, their spatial ability test is highly correlated with a general intelligence factor. Given that IQ is usually negatively correlated with time spent with television (cf Morgan and Gross, 1982), correlations between general spatial abilities and television viewing may be no more than artifacts of self- selective exposure to television. Harrison and Williams' (1986) cross-sectional and longitudinal analyses provide a truer test of an effect and they find none. Nevertheless, there was a marginal trend in Notel of increased general spatial abilities two years after television's introduction. Is this meaningless, or is it the case that more varied tests of spatial ability like those used in the cinematic codes research (cf Salomon, 1979) would have yielded significant differences? We are left with the possibility that television influences spatial abilities, a possibility that deserves further systematic research.

We will briefly mention an issue related to spatial abilities. An argument that has enjoyed some popularity is that television, being a "visual" medium, enhances development of the right hemisphere of the brain at the expense of the left hemisphere (e.g., Emery & Emery, 1976; Mander, 1978; Singer & Singer, 1983c). While this notion is testable, there have been no television investigations which incorporate a battery of tests assessing lateralized skills. Demonstrations that the hemispheres are differentially activated during television viewing have not produced consistent results (cf, Mulholland, 1974; Rothschild et al., 1986), and would not in any case be sufficient to indicate long-term effects.

Effects on Perseverance, Impulsivity, and Activity Level

Probably the single most common assertion about the cognitive influence of television on children is that it "shortens attention span". Usually the cause of the shortened attention span is attributed to television's rapid visual pacing. The following quotes are typical: "...there are incessant changes of camera and focus, so that the viewer's reference point shifts every few seconds. This technique literally programs a short

attention span" (Dumont, 1976 as quoted by Winn, 1977, p.14). "Teachers complain about their pupils' passivity, short attention spans, and lack of imagination -- characteristics attributable, at least in part, to TV viewing" (Swerdlow, 1981, p.52). Dorothy Cohen, an influential early childhood educator, is quoted as saying: "...children whose environment is heavily dominated by the frantic pace and speed of television are children likely to be easily distracted. For them, focusing and paying attention are a strain" (Moody, 1980, p.48).

A related set of complaints concerns the influence of television on activity level. Winn (1977), for example, blames *Sesame Street* as among the television programs watched by children which may "...contribute to the frantic behavior observed with greater frequency among children today." Winn also suggests that young children's behavior "deteriorates" immediately after watching television, with children "hopped up", "inattentive", with "wild running around."

The sum of these assertions is that television viewing, especially by very young children, reduces attention span and causes hyperactive behavior. These effects are claimed to occur immediately following viewing as well as chronically.

Evaluating these assertions is not straightforward, in part because there is no standard measure of "attention span", a concept that has long been abandoned in research in cognitive development (e.g., Moyer & Gilmer, 1955). The notion refers to perseverance on an adult assigned task, usually in a school situation. In general, there is an increase with age in task perseverance and behavioral attentiveness to arbitrarily assigned tasks (Davies, Jones & Taylor, 1984). Also, behavioral attentiveness to assigned tasks in the classroom has been shown to be highly predictive of achievement in the elementary grades (e.g., Samuels & Turnure, 1974). If television has the effects claimed, the educational impact might be substantial.

Typical of the literature on television's cognitive impact, there is only a meager scattering of relevant studies and these are of varying quality. The worst was reported by Halpern (1975). He discussed a group of 2-year-olds who were referred to a mental health center for problems with hyperactivity. A majority of the children were described as compulsively reciting numbers and letters learned from *Sesame Street*. In addition, Halpern noted that "while they delivered themselves of these speech fragments, the children often inspected their inanimate surroundings like restless, wound-up robots." (p.68). Halpern suggested that the children's hyperactivity was "directly traceable to *Sesame Street*". He argued that rapid pacing and repetition of the show "...evidently may be too much for some children to assimilate or to avoid successfully. When their nervous systems become overtaxed, they resort to diffuse tension discharge behaviors, exemplified by unfocused hyperactivity and irritability" (p.69). Subsequently, Halpern noted that he was not able to repeat these observations and attributed this to changes in *Sesame Street* production practices. Halpern did not provide any information about numbers of children observed, the reliability of observations, how these behaviors could be traced to television, or whether normal 2-year-old viewers of *Sesame Street* also recited numbers and letters. Ordinarily we would not cite such a paper, but it was published in the major communications journal, received widespread publicity, and is cited in virtually all popular books written about the effects of television. The paper is completely inadequate in a scientific sense and should not be taken as evidence for an influence of television on attention or activity level.

Other papers provide more useful information. Singer, Singer, and Rapaczynski (1984a) studied 63 nine-year-olds who were part of a larger study on TV viewing. The children were observed for restlessness in a waiting room, and were also tested for their ability to sit still for a length of time. Diary records of TV viewing behavior for two years prior to the observations were analyzed. Viewing of action oriented TV programs was mildly associated with restlessness in the waiting room, and a weak negative association was also found with ability to sit still. This correlational study does not allow conclusions of cause and effect relationships.

Anderson and Mcguire (1978), in a Canadian study, obtained teacher ratings of their students' "impulsivity" at school. No details were given as to the nature of this measure. The authors reported a small positive correlation between impulsivity and viewing of violent programs in 102 third and fourth graders, and also with total viewing in 198 fifth and sixth graders. Again, no causal directions can be inferred.

In a study with 72 five-year-old children (discussed further below), Anderson, Levin, and Lorch (1977) found no significant correlations of total amount of TV viewing (estimated by parents) with a test of perseverance in puzzle solving, with a test of impulsivity (Matching Familiar Figures Test), or with observations of activity levels during a 10-minute free play period.

Several studies have been experimental in nature. Friedrich and Stein (1973) compared three groups of children who attended a preschool summer session. For four weeks during the session each group was shown a total of 12 TV programs. One group of 30 children was shown an aggressive fantasy-action program (*Batman*); another group of 30 children was shown a preschool program from public television (*Misterogers Neighborhood*); and the third group of 40 children viewed a variety of children's programs which contained no aggression and did not emphasize the helping prosocial content that is contained in *Misterogers Neighborhood*. The children were observed in their classroom for persistence in carrying out assigned tasks, persistence in free play, and tolerance of delay. The authors reported an increase in tolerance of delay for the children who viewed *Misterogers* as well as for those who viewed the variety of children's programs. The children who viewed *Batman*, however, showed a decrease in tolerance of delay. High intelligence children who viewed *Batman* also became less persistent, and high intelligence children who viewed *Misterogers* became more persistent, with no effects shown by the group who viewed the mixed programs. This study indicates that viewing television may have effects on persistence and tolerance of delay, but since there are many differences between *Batman* and *Misterogers* besides violence, action, pacing, and prosocial content, an account of what causes the effects is not possible.

Tower, Singer, Singer, and Biggs (1979) studied three groups of children in preschool settings. One group of 21 children was shown *Misterogers* each day for 10 days; another group of 21 was shown *Sesame Street*; and a third group of 16 was shown a collection of educational films about animals, health, and nature. Among the measures taken were observations of the children's concentration during play. This was defined as the extent to which a child remained with an activity, resisting distraction, and not engaging in hyperactive behaviors. The results were reported in terms of changes in concentration by high and low imaginative children (measured separately). There was no difference in concentration between groups for high imaginative children (who were high in concentration initially), but low imaginative children substantially increased their concentration in all three TV viewing conditions. Findings such as these are difficult to interpret:

viewing television may have caused the increase in concentration or the children initially low in concentration may have been observed to be higher in concentration simply by regression to the mean (any observed extreme will tend to be less extreme on the next observation by the nature of random statistical variation). In any case, this result does not support claims that *Sesame Street* is responsible for "frantic" activity.

Anderson et al. (1977) experimentally tested the hypothesis that rapid pacing has immediate effects on attention and activity level. They produced two versions of *Sesame Street*: One version consisted of extremely rapidly paced short segments and the other version consisted of extremely slowly paced segments. Three groups of 24 five-year-old children participated in the experiment. One group was shown the rapidly paced program (each child viewed individually with a parent present), another group viewed the slowly paced program, and the third group had stories read to them by a parent for the same length of time. Immediately following the TV viewing or reading, each child was given the perseverance in puzzle solving and Matching Familiar Figures (MFF) tests. The MFF test examines the child's impulsivity while doing a simple visual matching task. Immediately following the tests, the children's activity levels during free play were observed. No group differences were found on any measure. Thus, there was no evidence of an immediate effect of rapidly paced television on perseverance, impulsivity, or activity level.

Salomon (1979) showed *Sesame Street* in school to 57 Israeli second graders over 8 days. A comparison group of 57 second graders watched adventure and nature films for the same amount of time. Among other measures (described earlier), the children were required to do a "tedious" test of perseverance which required the child to cross out a selected group of numbers (from several pages of random numbers) as they were called out one at a time. The children who had watched *Sesame Street* showed less perseverance than the comparison group. This experiment shows only that television can influence perseverance. It is impossible to know from the experiment whether the adventure and nature films increased perseverance or whether *Sesame Street* reduced perseverance or both. It is also impossible to determine what differences between the programs were crucial to producing differences in perseverance. It should be pointed out that *Sesame Street* is generally oriented toward a younger audience than second graders; it is possible that 8 days of required *Sesame Street* viewing produced some restlessness due to boredom.

Finally, Gadberry (1980), as part of her experimental study of restricting 6-year-old middle-class children's home television viewing, administered the MFF test of impulsivity after the 6 week restriction period. The restricted TV boys showed less impulsivity than the unrestricted children. In detailed analyses, Gadberry noted that the restricted children primarily reduced viewing of commercial television with violent content; in general, she found that children who watched public television, especially *Sesame Street* and *The Electric Company* were less impulsive.

In sum, the published research suggests that television viewing affects perseverance and impulsivity, but there is not enough evidence to indicate whether television viewing *per se* produces the effect or whether specific types of content or production techniques are responsible. Since some of the effects are in a positive direction and others are in a negative direction, it is possible that television is capable of influencing attention in both desirable and undesirable ways. The correlational research (2 out of 3 studies finding effects) is suggestive that violent action content is associated with deleterious effects, but no causal direction can be safely assumed (i.e., restless impulsive children may prefer violent content). The experimental research is only indicative that a causal effect may be present, but due to lack of experimental controls, the specific features producing the

effect were not isolated. Only one experiment specifically manipulated program pacing, the most commonly suggested causal factor in reducing attentional skills. That experiment found no immediate effects. The possibility that rapid pacing may produce effects over longer exposure has not been examined.

If perseverance, restlessness, and impulsivity are influenced by television, as the evidence weakly indicates, a great deal more needs to be done to clarify the nature of the influence. Consider the following possible mechanisms: Television viewing may increase restlessness due to lack of physical activity; children may imitate the attentional behaviors demonstrated by characters on television; some television programs may increase or decrease arousal with subsequent consequences for performance on attentional tasks -- it is well known that arousal influences performance on vigilance tasks, and that the effects depend on task complexity (e.g., Parasuraman, 1984); the pacing of television's units of content may be internalized in some way analogous to the internalization of filmic codes as discussed above. Other mechanisms are, of course, possible. Sorting out the causal effects, identifying interactions with age and other individual differences, and isolating program elements that produce the effects will take systematic and programmatic experimental as well as correlational research. There does, nevertheless, appear to be some effect of TV on attention, yet the importance, generality, and nature of the effect is unknown.

Unexplored possible effects on attention. To us, the most likely effects of television on attention would involve direct transfer of modes and strategies of attention to television itself. Consider what is known about children's attention to television: Looking at TV is strongly associated with listening at the level of sentence meaning; looking is ordinarily maintained for a short time before looking away, although episodes of looking of several minutes duration sometimes occur; sequential division of attention between television and a concurrent activity is common; looking occurs when the child judges the material is comprehensible; looking occurs when auditory cues indicate that comprehensible and entertaining material is present; looking occurs when special effects and humor are used; looking ends when a content unit ends; the longer looking is maintained, the more likely it is that it will be maintained, conversely, the longer attention to the concurrent activity is maintained, the more likely it is that the concurrent activity will be continued (attentional inertia); once looking at the TV or involvement in a concurrent activity is maintained for about 15 seconds, the child is more intensely involved, and becomes less distractible.

It is unknown to what extent these modes of attention are transferred *from* other domains *to* television, or to what extent they are transferred *from* television *to* other domains. If the latter type of transfer occurs, one might speculate: 1) Children may have a tendency acquired from television viewing to sequentially divide attention, perhaps between a teacher delivering instruction and another activity, such as drawing pictures. When engaged in the concurrent activity, the child is considerably less auditorily attentive. If the teacher does not use distinct auditory cues to draw the children's attention to central points, as the child would expect from television, the child might miss these points. 2) Children may require a visual center of focal attention in order to acquire essentially auditory material. This follows from research showing that young children acquire some kinds of auditory material better when there is video to go with that material (Gibbons et al., 1986; Greenfield and Beagles-Roos, in press). 3) There may be a period of about 15 seconds of continuous visual attention required before children become fully involved with instruction; conversely, if the children's attention has been lost for more than 15 seconds, it may be relatively difficult to regain it. 4) Concluding a unit of

instruction may have the effect of losing children's attention for a period of time. 5) Children may require more humor, action, and the classroom equivalent of special effects to maintain attention. This latter point has been raised repeatedly in popular critiques of the effects of television.

None of these potential influences has been examined through research, but since they are derived from attentional patterns observed during children's television viewing, they should be considered at least possible.

Effects on Mental Effort

A common claim is that television produces intellectual passivity and low levels of cognitive involvement in other activities. Singer (1980) attributes this effect to the rapid pacing of television which allows little opportunity for reflection and mental elaboration. Salomon (1983a,b), on the other hand, suggests that such effects may be due to the perceived ease of television viewing. The ease of processing television may possibly carry over into expectations of other domains: "It is not impossible that children acquire the expectation that pleasurable information can be obtained effortlessly, an expectation they then carry over to written material" (Salomon, 1983b, p.75).

We have already noted that viewers tend to rate television as relatively undemanding and that they also rate themselves as expending low levels of mental effort in cognitively processing television. These ratings vary considerably, however, with specific situational demands. The question is whether TV viewing produces a general tendency not to expend mental effort, i.e. not to infer, reflect, or elaborate.

Unfortunately, there is little evidence on this issue. Considerations of attention and comprehension of television already discussed indicate that children do mobilize attentional resources and engage in inferential activities when watching television.

In studies described in more detail in the section on creativity and imagination, Greenfield, Farrar and Beagles-Roos (1986) and Greenfield and Beagles-Roos (in press) found that story recall and imaginativeness of story completions were greater across media when children were first exposed to radio, rather than television versions of the stories. They suggest that the radio version induced perceptions of the task as being difficult. Therefore, when asked to repeat the task at a later date with a TV stimulus, more effort was expended. This interpretation may be valid. Unfortunately, there were no direct measures of perceived ease, difficulty, or invested effort.

Roberts, Bachen, Hornby, and Hernandez-Ramos (1984) asked elementary school children to self-rate both the amount of mental effort they expended in TV viewing and reading and to rate the ease of learning from each medium. Amount of mental effort expended in TV viewing had no value in predicting reading achievement, although self ratings of mental effort expended in reading did predict reading achievement in third and sixth graders. Unfortunately, the relationship between amount of effort exerted in TV viewing and amount exerted when reading was not reported. Thus, the information most relevant to the question of whether "easy" TV engenders a lazy information- processing style is lacking.

The perceived ease of the respective media as sources of learning are no more illuminating. Roberts et al. (1984) note that for sixth graders: "...children who perceived television as an easy means for learning about things tended to obtain higher reading

achievement scores" (p.36). It is quite possible that this relationship results from brighter school-age children finding television easier to process than their less intelligent peers. It may be the case that brighter children find reading easier, too, but they exert more effort in reading because it is judged to be a more accurate or important source of valuable information. This would seem to contradict Salomon's transfer of low mental effort hypothesis. Since we lack the correlations between TV effort and reading effort, however, the validity of either of these plausible hypotheses remains unsupported.

On the whole we can add little more to evaluating the claim that television makes children intellectually passive than Schramm et al. (1961): "Few children we have observed would trade an active experience for a passive television experience which would satisfy their needs no better. The vicarious satisfactions a child can get through television are almost invariably lower on his hierarchy than the satisfactions he can get directly -- providing of course, he *can* get the direct ones" (p.159). They go on to point out that Himmelweit et al. (1958) "...found in England that teachers rated viewers as high as nonviewers on initiative and imagination" (p.160).

Future research on this issue would do well to operationally define "passive" or "active" intellectual capabilities. Perhaps the emphasis in such work should be on productive activities such as writing, rather than on receptive activities such as reading. Such productive activities presumably require the most "active" intellectual processes.

Effects on Creativity and Imagination

It is frequently claimed in both popular literature and research journals that television viewing leads to decreased imaginativeness, fantasy play and the ability to be creative. These arguments are largely based on a view of television as a visual medium. By presenting concrete visual images, TV obviates the need for children to spontaneously produce their own representations of an ongoing narrative, as they would, it is argued, in listening to or reading a story (e.g, Singer, 1980; Greenfield et al., 1986). Others argue that while *productive* imaginative capacities might not be activated during television viewing, the wealth of visual images presented on TV provides children with a storehouse from which they can draw when engaged in imaginative episodes (e.g., Brown, 1986).

Another controversy centers around the fact that television programs present information in an ongoing continuous manner. This is seen as preventing children from generating their own hypotheses about "what comes next" or reflecting on what had come before. Alternatively, it is argued that the 'mind's eye' of the child is not inactivated by the TV, rather, children often use the just observed content on television as a point of departure for fantasy play in the presence of the TV set.

In addition to hypothesized direct effects, there are also assertions of indirect effects due to television's role as forming a common culture for young children, thereby reducing the diversity of ideas. Finally, by becoming an ever present "default" activity, it is argued that television may reduce the child's inclination to engage in a diversity of activities during free time (Singer and Singer, 1986). By reducing the diversity of activities, the child's experiences and knowledge base become limited, thereby reducing the potential for creativity.

Before we evaluate the evidence, it is helpful to distinguish between what we see as two different classes of cognitive activities, namely fantasy and imagination versus creativity. The former primarily addresses the tendency to exhibit fantasy and imagina-

tiveness in play. Interest in and emphasis on the importance of imaginative development and fantasy play can be traced to the central role it plays in Piaget's theory of early cognitive development. For Piaget, the ability to represent objects symbolically is the hallmark of early cognitive development and its manifestations are seen in imitation and symbolic play. While the exact role that fantasy play has in cognitive development has not been ascertained, its importance as a marker of particular capacities (e.g., symbolic representation) and as a vehicle for both self and object exploration are widely recognized. Television studies examine the relationship between the quality or frequency of imaginative play and the amount, and sometimes types of programming viewed by the child.

The second ability, creativity, is largely seen as the complement to abilities tested by general intelligence exams. Intelligence tests, by design, are good predictors of school achievement. As such, they are often thought to measure the ability to think in ways that conform to standard academic demands. Measures of creativity, on the other hand, which do not correlate highly with intelligence scores, are thought to reflect an ability to generate both a unique set and a large number of ideas. These two aspects of creativity have been labeled divergent thinking and ideational fluency, respectively, and are generally highly intercorrelated and stable over time. Clearly, fantasy and creativity overlap to some extent, by sharing certain component processes. For example, both creativity and fantasy play require the generation of ideas. However, as defined above, they are hardly synonymous terms. Thus, television may selectively influence one of these abilities while not affecting the other or the relationships might be in opposite directions. Finally, if effects *are* identified, the mechanisms by which they are realized may well differ.

We begin by examining research that observes the capacity, frequency, or quality of fantasy play and imagination. A logical place to look for immediate effects of television viewing on fantasy play is in the television viewing situation itself. If a large proportion of young children's time is spent television viewing, and television viewing itself does not incorporate self-generated fantasy or imagination, then cumulatively television may displace imaginative play. Indications are to the contrary: Television content is often used as a point of departure for fantasy play that then occurs in front of the television (Reid and Frazer, 1980). Furthermore, as we noted earlier, the flow of information in a television narrative does not prevent the generation of hypotheses of what will happen next nor does it prevent interpretations of action sequences. In fact, television viewing may encourage these activities. In a thirty hour observational study (spanning five months) of six- and nine- year-old brothers' interactions during television viewing, Alexander et al. (1984) found that the two most frequent functions of TV-related conversations were interpretation and projection. Projection consisted almost entirely of imagining, i.e., it was used "...to maintain representational play" (p.352). For young children, then, television viewing is not devoid of using their imaginative capacities.

The fact that children demonstrate use of imagination while television viewing does not preclude the possibility that other media are more stimulating of imagination. In fact, Greenfield and her colleagues (Greenfield & Beagles-Roos, in press; Greenfield, Farrar & Beagles-Roos, 1986) recently published several reports suggesting that children provide more imaginative endings to audio ("radio") rather than audiovisually ("TV") presented stories. The two versions of each story had the same audio track. Thus, the TV versions differed from the radio versions only in that they included additional, complementary animated images. Each of forty-eight white middle-class children saw/heard one of the four incomplete radio/television stories, and was asked to provide an ending. One week later the child saw/heard the other story in the other medium. Story completions were

scored for imaginativeness. Number of imaginative words was computed as the total number of words minus the number of repeated words. Repeated words were those "echoing" the words or images of the story. In addition, the frequency of qualitative components such as imaginative events, vague characters, and location settings was tallied.

Though the majority of completion words were imaginative for both TV and radio story conditions (89% and 97%, respectively), more imaginative words, imaginative events, and vague characters were used to complete radio than television stories. Radio stories elicited longer average completions than television (98.4 total words versus 80.4). Media effects were modified by interactions with story and age. Averaging across ages, there were no media differences for what was judged by the authors to be the more difficult story. When age was considered, younger children were more imaginative in response to the TV version of this story, while the older children showed the expected advantage for the radio version. The authors conclude that the radio stories stimulated the children's imaginations more than the TV presentations. While this may be true, the statement should be modified to reflect that this is the case only when the story is readily comprehended by the child.

One could argue that the TV completions were not less imaginative, but that they were simply more succinct and less repetitive. Since the audio-visual versions provide more information, completing the story requires less elaboration. Consider the following two sentences. 1) A person was walking down a street when something happened and the person stopped. 2) An old man with a cane was walking down a street when a traffic light signalled "don't walk", so he stopped. A person given the first sentence would be expected to provide more novel detail and non- repetitive information than an individual asked to complete the second version. Given that the radio completions were longer and consisted of fewer repetitions than the television completions, this explanation is a viable alternative. In this case, the effect is not due to the media, but simply to the completeness of the information provided.

Greenfield and Beagles-Roos (in press) included white working class and black middle and working class groups in a two part study of imagination and recall that used the same design and stimulus stories. Radio completions again consisted of more imaginative words, events, and vague characters. The effect was limited to white children. For blacks, imaginativeness did not vary across media. Given that the average total number of words was by far the least in this group, the lack of a media difference may reflect a general reluctance to respond.

In the second part of the study, children's memory was tested for the same radio and television stories used above, except in this case the stories were complete. Of importance to the question of imagination, children made the same inferences across media but justified them on different bases. Inferences reported after the TV stories were significantly more often based on audio, audio- visual and action information. For radio stories, however, significantly more justifications were based on information not contained in the stories. It is unclear whether this is because 1) the story information is insufficiently memorable in the radio versions (as suggested by recall results) such that general world knowledge is drawn upon to provide an answer to the query, or 2) the inferences are made at the time of listening by using extra-story knowledge, or both. Earlier we noted poorer comprehension of audio-only stories by young children. Thus one could conceive of children in the radio condition basing their inferences on world knowledge because the story information was not well understood. The authors contend that the results of these studies indicate that because radio provides less concrete information,

children's imagination receives greater stimulation. Moreover, they speculate that repeated exposure to televised stories may produce less imaginative children. In our opinion, however, the results of the Greenfield et al. studies are open to the simple alternative explanation that, given more complete information in presentation of a story, children use that information in providing endings. The carryover effect from one week to another may simply be due to social facilitation resulting from more talking to the experimenter following the radio version. The results of these studies are, nevertheless, intriguing and bear replication under conditions where amount of explicit information is not confounded with presentation medium.

Several studies which assess television's influence on fantasy play and imagination have been conducted in preschool settings. James and McCain's (1982) approach was unique in that they described the play that occurs in a preschool, including the contribution that television makes to the quality and format of that play. They report that television content was incorporated into play, and that the conditions of when, what and how it was used varied according to age. For example, four- and five-year-olds used television content more frequently in their play than three- or six- and seven-year-olds. Still older children, on the other hand, showed increased conversation about television. James and McCain classified the major themes of observed play and found that not only are both TV and non-TV play comprised of the same themes, but that these are consistent with themes described as characteristic of Western culture in previous times. Most interestingly, James and McCain report that when children incorporate television characters in their play, more children tend to join in; they then are often more willing to try things that they think will be difficult; they are also more likely to explore the feelings of people with different societal roles; and they report having more fun. This qualitative description of group play indicates that, by providing a common culture from which to draw upon, television content adds variety to play that is based on well established cultural themes. It is not clear whether such play is inherently less or more imaginative than play based on themes that do not derive from television.

Work originating in the laboratory of Dorothy and Jerome Singer at Yale University is the primary source of information addressing individual differences in imaginative play, home environment, and television viewing. In an early study (Singer and Singer, 1976) preschool children were assigned to one of four conditions varying in the degree of training in imaginative play. Imaginative predisposition was assessed prior to the two week experimental period via an interview and responses to Barron Inkblots. In addition, free play was scored during two ten-minute observation periods for the frequency and degree to which a child introduced, "...elements of time, space, or character not immediately given in the perceptual environment" (p. 76). One group of fifteen watched *Mister Rogers* each day for half an hour. A second experimental group of fifteen watched *Mister Rogers* with an adult who drew attention to specific parts of the program, and at times encouraged imitation of the show. A third group played open-ended games with an adult each day. Finally, a control group participated in the normal preschool routine during the experimental period. After intervention, free play was again scored for imaginativeness.

The results show a significant difference in change scores as a function of condition. The control group, who initially scored higher in imaginative predisposition, decreased in imaginativeness of play. The experimental groups all showed increased imaginativeness from pre- to post- experimental observation periods. The TV alone group showed the smallest change, followed by TV and adult, and the adult play training showed the greatest positive change. No tests were conducted to determine whether the mean change

scores for any of the groups was significantly different from zero. Thus, it is unclear whether the changes are meaningful. In addition, there were no pair-wise tests of the experimental groups' mean scores to see if they were significantly different from one another. Thus, regression toward the mean could well be responsible for the results. In any case, as the Singers conclude, there was little evidence that television, *per se*, had an impact on preschoolers' tendency to engage in imaginative play.

Tower et al. (1979) asked whether exposure to programming that had different emphases and formats would differentially influence preschoolers' imaginativeness. Fifty-eight nursery school children were individually observed for a ten minute period twice during the two weeks prior and subsequent to experimental intervention. From these ratings of imaginativeness during preschool play, a change score was calculated. Again, imaginativeness was defined as "the extent to which a child transcended the constraints of reality in his or her play" (Tower et al., 1979, p. 271). This would include using an object to symbolically represent another. Children were assigned to one of three groups that saw a one-half hour program of either *Mister Rogers*, *Sesame Street*, or educational films about animals, health, and nature each day for two weeks. *Mister Rogers* was judged by the investigators to emphasize imaginativeness more than *Sesame Street* which, in turn, was believed to emphasize imaginativeness more than the comparison films.

Despite the assumed variability of imaginativeness in the content of the programs, Tower et al. (1979) found no group differences in degree of change in imaginative play. A second analysis was conducted to see if children grouped as above or below the median in imaginativeness *before* intervention showed differential patterns of change. Not surprisingly, given the phenomenon of regression toward the mean, children who were initially above the median tended to decrease in observed imaginativeness, and those below the median tended to increase. The magnitude of increase was on the average greater than the magnitude of decrease, thereby yielding a significant finding. For low imaginative children the increase was greatest for those who watched *Mister Rogers*. Since the study lacks a no-viewing control condition, and since low imaginative children in all conditions increased significantly, we would be more cautious in interpretation of the results than Tower et al. (1979). They state, "...television programs helped the initially low- imagination children improve, whereas the films did not ... Clearly, television was shown to play a beneficial role in the development of these children" (p.278). Given their earlier results (Singer & Singer, 1976), and since the change analysis was not significant, the conclusion is overstated. We suggest that the findings indicate such an effect is possible.

As part of a longitudinal study, nursery school children's play was rated for imaginativeness as defined above, by observers who were blind to the purposes of the study (Singer & Singer, 1981). In addition, parents kept diaries of the children's television viewing. What is often cited in the literature are the indications from this study of a small positive correlation between situation-comedy viewing and imaginative play, and a small negative correlation with action-adventure viewing. In addition, children who had imaginary playmates tended to view less than their peers (e.g. McIlwraith and Schallow, 1983; Greenfield et al., 1986). In fact, correlational analyses indicated that while imaginativeness was relatively stable over a year's time and was correlated highly with positive affect, liveliness, elation, and extensiveness of language use, there was no significant relationship with television exposure. When children were dichotomized into groups of more or less imaginativeness, it appeared that boys who were more imaginative tended to watch more television.

Singer, Singer and Rapaczynski (1984b) extend these results somewhat, but provide qualifications and information about the contribution of background characteristics. A longitudinal study following sixty-three children from age five through age eight measured average weekly television viewing for each year from parent logs. At age eight, imaginativeness was measured by 1) a standardized test that called for responses to ink blots, 2) an imagination interview asking about favorite games, etc., and 3) ratings of an observed play session with blocks. Individual multiple regression analyses were conducted for each dependent measure using only one year of television viewing at a time, plus other background variables as predictors.

The Human Movement Ink Blot results indicated that less preschool television exposure, especially less exposure to violent or "motorically arousing" programs, was associated with more imaginativeness at age eight. However, as is the case for all the regression analyses reported, the relative contributions of the television variables is very small. In fact, the best predictors of imaginativeness (as indexed by the three measures) were variables such as having a mother who values imaginativeness and curiosity, living in a household with orderly routines, having parents whose child rearing practices are inductive, and having a varied cultural life. The other small contributions of television to imaginativeness that were identified were 1) exposure to fantasy rather than realistic adventure programs increased scores on the imagination interview, and 2) less exposure to action-adventure programming increased scores on block play. The results indicated, then, that if television viewing contributes to imaginative abilities, its contribution is very small and not always negative. Given the results of the previous studies, and since the constellation of home variables primarily predicted imaginativeness scores, it is not clear that television makes a unique and meaningful contribution to children's imaginative capacities. It is unfortunate that the authors come to the opposite conclusion, focusing on the statistical significance rather than meaningfulness of the results.

McIlwraith and Schallow (1983) sought to determine whether there was a relationship between television and the themes of children's fantasy lives. A "multidimensional measurement of styles of fantasy" (p. 326) was administered to eighty-two first-grade children. Scores on three subscales were derived from their responses. These scales were: 1) Negative-aggressive-absorbed fantasy, described as dysphoric, 2) Fanciful-scary--vivid fantasy, believed to index healthy, make-believe play and 3) Active-intellectual fantasy. Amount of television viewing was indexed as the number of correctly identified photographs from twenty different programs. Correlations between the television identification measure (TVI) and scores on each of the subscales were calculated after first removing the variability that each measure shared with IQ. Fanciful fantasy scores were positively, but non-significantly correlated with TVI. Negative-aggressive fantasy was significantly correlated ($r = .29$) with TVI scores for the groups as a whole and for girls ($r = .35$). The authors also report that situation comedies, soap operas, and non-violent dramas are especially implicated. However, since neither the number of pictures per program type, nor the range of program types was reported, it is difficult to assess the predictive value of these specific relationships. Nevertheless, as the authors conclude, this study finds no support for the thesis that television replaces imaginative fantasy, thereby hampering its development. On the other hand, their findings suggest that further work is necessary to determine if children watch more television as an escape from unpleasant fantasies or if heavy television viewing in part causes such unpleasant fantasies. We would add to this suggestion, the need to replicate their results with more sensitive measures of television viewing than the television identification technique.

The research on imagination thus far indicates that there are small relationships, both positive and negative, between TV exposure and various measures of imagination and fantasy. There is as yet no convincing evidence that television plays a causal role in producing these relationships.

As we noted earlier, it is commonly asserted that television decreases children's creativity. The only experimental study of which we are aware that used standardized measures of ideational fluency and divergence is that reported by Runco and Pezdek (1984). They were interested in assessing whether television viewing or radio listening led to differential performance on these tests. Thirty-two third-graders and thirty-two sixth-graders were presented with either an audiovisual or audio only version of a story. The audio track was identical for both media conditions, so extra visual information was presented in the audiovisual condition. Individual analyses of ideational fluency, originality and flexibility all yielded an effect of grade but no difference for medium of presentation. Thus, creativity as applied to a body of just-presented information does not appear to vary as a function of whether concrete visual images are conveyed. This investigation, of course, does not indicate whether cumulative exposure to television affects creativity.

Harrison and Williams' (1986) examination of television's arrival in a small Canadian town included two measures of creativity. Fourth and seventh grade children were asked to enumerate as many different uses as possible for each of five common objects, the Alternate Uses task. In addition, they were shown five different patterns of lines, curves and circles and asked to think of all the things that the complete patterns could be, the Pattern Meanings task. Both sets of responses were scored for ideational fluency and originality (divergence). Since fluency and originality were highly correlated, only fluency measures were used during Phase II, two years after television's arrival.

Analyses of the Alternate Uses task indicated that the introduction of television decreased children's creativity. Children raised without television were initially superior on this task compared to those raised with television. After television arrived, this difference was eliminated. The Pattern Meanings task did not corroborate these findings insofar as there were no meaningful differences between towns during either Phase. Harrison and Williams suggest that this measure may not be as valid an index of creative abilities as the more verbal Alternate Uses task.

What aspect of television might have been responsible for its effect on the ability to think of alternative uses for an object? We will consider three possibilities. James and McCain's (1982) description of television as a common culture raises the possibility that by providing large groups of children with the same set of experiences, television reduces the relative originality of ideas. Second, as Harrison and Williams (1986) suggest, it may be that in watching television, children are exposed to a smaller range of activities, or may have less experience with "coming up with something to do" (see also Medrich et al., 1982). The fact that Harrison and Williams found no evidence that amount of viewing predicted creativity casts some doubt on these explanations. A final hypothesis, also raised by Harrison and Williams (1986) is that the Alternative Uses task can be viewed as a perseverance task. The child must stay on task longer to generate more ideas. In the case of the Pattern Meanings task, the figures may have been so abstract as to suggest very few possible concrete identities to the children, thus higher scores would be far less attributable to time on task. If television viewing leads to decreases in perseverance, as considered in the section on effects on attention, then one might expect children to do more poorly on the Alternative Uses task. The evidence on this, however, is mixed,

insofar as some studies find increased perseverance; the effects may well depend on the types of content viewed.

What can we conclude about television's effects on imaginative capacities and creativity? Television may require less productive use of imaginative capacities than listening to a story. However, it has not been demonstrated that over time this experience diminishes imaginative capacity. In addition, there is no evidence that the product of television inspired imagination is of poorer imaginative quality than that inspired by radio. In general, television does not appear to interrupt the development of fantasy play or imaginativeness. In fact, its incorporation as a common cultural experience into group play in preschool settings may be facilitative in forming friendships, promoting role-playing and adding variety to play. One study indicated that unpleasant fantasies may be related to higher levels of viewing. The direction of causality in this relationship has not been established, however, and the finding itself should be replicated with more detailed measures of television exposure before great confidence is placed in it. Television may negatively influence creativity, but the evidence for this is limited to one of two tasks used in one investigation. This effect may actually reflect decreased task perseverance or it may genuinely reflect a reduced ability to think of alternative possibilities. It remains for further work to clarify this issue.

Effects on Reading

Numerous correlational studies have reported negative relationships between reading achievement and amount of television viewing and some have reported positive relationships. In a meta-analysis of the correlational literature covering reading achievement with concurrent estimates of TV viewing in school age children, Williams, et al. (1982) argue that the relationship is positive for viewing up to about 10 hours per week and negative thereafter. They further argue that the negative relationship is stronger for girls and high IQ children. The negative association of reading achievement and TV viewing is also observed when TV viewing during the preschool years is considered as a predictor of later reading achievement (Burton, Calonico & McSeveney, 1979; Singer & Singer, 1983), although Singer and Singer (1983) note that for lower SES children with self described imaginative and curious parents, the relationship is positive. Not surprisingly, a host of SES, parent education, family attitudes toward print media, and family environment variables also predict reading achievement and themselves tend to be correlated with TV viewing, so that straightforward causal accounts of the relationships are not readily apparent (e.g., Roberts et al., 1984).

Neuman (in press) conducted an impressive study that analyzed the data from eight different state wide educational assessments that included measures of television viewing and reading achievement. She found that when the data from each state was considered separately, viewing up to two to three hours per day was often positively correlated with reading scores. The opposite was true of viewing more than three hours per day. When the eight data sets were considered together, however, TV - reading relationships were on the whole small and not significant. In addition, considering several alternative models of the displacement hypothesis, Neuman found no evidence that television viewing displaces reading.

There is some evidence from studies of the arrival of television that a causal negative influence of television on initial acquisition of reading skills may exist. Hornik (1978) found that acquiring a TV set was associated with slowed development of reading achievement in El Salvador junior high school students. The reading achievement mea-

sures were group tests administered in schools.

Corteen and Williams (1986) examined reading skills in three Canadian towns two years apart in the early 1970s. Since this study is of considerable potential importance for assessing television's impact, it will be described in some detail. The town of primary interest, designated Notel, had no television during the first assessment which occurred just before television's arrival. The other two towns, Unitel and Multitel, had one and four channels of television available, respectively. Two measures were used for assessing reading achievement in second, third, and eighth graders: identification of individual words, nonwords, and short phrases briefly presented in a tachistoscope, and group reading achievement tests. The group reading achievement tests, unfortunately, were administered 6 months *after* television had arrived in Notel, so only the word and phrase identification measure was uncontaminated by experience with television.

In the first phase of testing, before television had arrived in Notel, there were no town differences in identification scores for second grade girls, but Notel second grade boys scored higher than boys in the other two towns. In the second phase of testing, two years later, these differences had largely disappeared. These results were somewhat complicated by apparently lower IQ in Notel second grade girls but a variety of analyses which attempted to control for IQ generally verified better performance by Notel second graders in Phase 1 with differences disappearing later. These analyses provide some indication that lack of television benefits word and phrase identification. Analyses for third graders showed no sex differences; in Phase 1 Notel scores were equalled by Multitel and both towns were superior to Unitel. In Phase 2, Notel third graders scored significantly worse than the other two towns. The third grade results provide no evidence for a negative effect of television unless the decline of the Notel scores indicates a deleterious effect limited to the novel period of time associated with the arrival of television. The eighth grade results showed no Phase 1 differences between Notel and Unitel although both towns scored higher than Multitel. These same effects were preserved during Phase 2 testing. The eighth grade results support no unambiguous interpretation concerning the effects of television. In sum, the most unambiguous result was that second grade boys in Notel identified more words and phrases than second grade boys in the other towns.

The results for the group reading achievement test yielded a difference attributable to television only for comprehension of second and third graders combined: during Phase I, Notel children scored higher than children from the other two towns which did not differ. There were no differences between the towns in the higher grades. Corteen and Williams (1986) also reported correlations between amount of TV viewing and reading scores: These correlations were generally negative, as found in numerous other studies (cf, Williams et al., 1982).

While the Corteen and Williams (1986) results are suggestive that television may play a causal role in reducing reading skills, the overall pattern of effects was not impressive. Most important from our point of view, was the failure to find differences in the group reading test scores in the higher grades. The older children from Notel had learned to read and engaged in reading for years without the influence of television. If television truly has a lasting deleterious effect on learning to read in the early grades, then one would expect that Multitel and Unitel children would have shown these cumulative effects in the upper grades. Instead, there were no differences.

R. Anderson et al.'s (1986) extensive study of the relationship between children's out

of school activities and reading proficiency shows little impact of television. One hundred fifty-five Illinois fifth graders completed daily out-of-school activity inventories for periods ranging from eight to twenty-six weeks. Reading comprehension as measured by standardized achievement tests, vocabulary, and reading speed were all measured in fifth grade. These measures, as well as growth from second grade reading achievement scores were regressed on number of minutes spent in different categories of activities covered by the inventory. Time spent reading books was by far the single activity that most accounted for reading proficiency. Moreover, after second grade reading ability was partialed out of fifth grade comprehension, time spent reading books was the best predictor of comprehension growth. While television viewing was negatively correlated with book reading, this relationship was nonsignificant. The authors write that there was "...no strong evidence that any out-of-school activity interfered with book reading (p. 17)". Most impressive for our purposes here, was the finding that while more time was spent viewing television each day than any other out-of-school activity listed, TV viewing never entered the regression equations as a significant predictor of reading achievement in contrast to other activities such as household chores (negative), or listening to music (negative). It should be pointed out that like other investigations, this study found small simple negative relationships between TV viewing and some aspects of reading achievement. These relationships, however, disappear when considered in the context of other out of school activities.

Two longitudinal investigations have examined the relationship between amount of TV viewing and later reading achievement. Neither Ritchie, Price, and Roberts (1987), who examined California children, nor Salomon and Shavit (1986), who examined Israeli children, found convincing evidence that earlier amount of television viewing was related to later reading achievement. The evidence that television retards reading achievement, then, is weakly based on small negative simple correlations between TV viewing and reading achievement, as well as on two studies of the arrival of television in Canada and El Salvador. The Williams et al. (1982) and Neuman (in press) analyses suggest that the true relationship may be curvilinear: positive at low levels of viewing and negative at high levels. Even so, the relationship reported in these reanalyses of multiple studies is extremely small (a correlation of -.06 in the Williams et al. analyses and an even smaller correlation in the Neuman analyses).

Granted that television may slow reading development in some children, what might account for this effect? The obvious possibility of displacement has not yet received much research support, as we saw in some of the studies above and in the section on displacement. There is also no consistent evidence that television reduces vocabulary acquisition, with some evidence suggesting the opposite (see discussion in the knowledge--base effects section, above). Since reading is a complex skill, and television viewing can in principle interfere with reading in a large variety of ways, we consider a number of possibilities.

Schorr (1983) and Moody (1980) cite Edgar Gording, a "vision expert", to the effect that television viewing reduces necessary eye movement practice in young children. Without such practice making eye movements, reading development is retarded. As discussed earlier, it is probably the case that there are relatively few eye movements within looks at the television. Unfortunately for this hypothesis, children frequently look away from television during which eye movements may occur. There is, in any case, no evidence that lack of practice or faulty eye movements have anything to do with reading difficulties except in certain rare pathological cases (Rayner, 1985).

A plausible hypothesis is that television viewing reduces interest in reading. This could happen because television viewing is perceived as "easier" than reading (Salomon, 1981). While the hypothesis receives support insofar as children by and large *do* perceive television viewing as easier, there has been no demonstration that such a perception blocks interest in reading or learning to read (Roberts et al., 1984). After detailed examination of the data from their new longitudinal study of TV viewing and reading, Salomon and Shavit (1986) argue that there are complex relationships between IQ, effort invested in reading or TV viewing, and reading achievement. Their results, however, may be limited to countries which require frequent subtitle reading by their TV viewers. As yet, the hypotheses that perceived ease of TV viewing or that actual effort expended in TV viewing have effects on reading achievement have not received strong support.

Another explanation for reduced interest in reading caused by television is that the effect is synergistic with general family attitudes toward reading as a leisure activity. If parents have low interest in reading and do not value literature, they may spend time TV viewing which in other families might be spent reading. It is the case, in fact, that parental low interest in literature is associated with higher levels of television viewing, and such parents tend to have children who also have low interest in literature and high levels of TV viewing. Conversely, parents who have a high interest in literature provide an environment supportive of reading and also tend to have low levels of TV viewing (Morrow, 1983). Such effects could be produced by a combination of values communicated to children and behavioral modeling. In other words, there may be a group of children whose parents have a low interest in reading *and* they model television viewing as the default leisure time activity.

In our review of the effects of television on cognitive processes and attention, we found some evidence that television does have effects, but most of these effects have no obvious relation to reading acquisition. One exception concerns the scattered findings that television viewing of some kinds of content may reduce task perseverance or increase restlessness. It is possible that such reduced task perseverance may act to reduce reading achievement, especially during early reading acquisition when reading is difficult and perseverance may be required (cf, Samuels & Edwall, 1981). As yet, however, we know of no evidence which specifically links television viewing, reduced perseverance, and low reading achievement.

An additional possibility is that the comprehension skills developed through television viewing are initially irrelevant to reading or may even interfere with reading. This possibility is suggested by an experiment in which third and sixth grade children were presented stories as text with pictures, as radio stories, or as television stories (Pezdek, Lehrer & Simon, 1984). While text comprehension performance was positively correlated with radio comprehension, that is, those children who did well on text did well on radio, there was no significant correlation between text and television comprehension. The authors note that the auditory material on television tends to be processed when the child looks at the TV and suggest that there may be a synergistic audiovisual integration unique to TV viewing, at least in children. Without the integrated visual support, comprehension of radio may be more like reading at least insofar as an early reader must learn to "listen" to his or her own vocal or silent decoding of the text. Related to this point, Beagles- Roos and Gat (1983) and Greenfield and Beagles-Roos (in press) found that children showed similar patterns in recall of radio to those Meringoff (1980) found with picture-books. In both cases these patterns were different from recall of television stories. It is possible that extensive experience with television may subtly retard the development of ability to listen without a visual frame of reference. At this point, such a

possibility is purely conjectural and is likely temporary and limited to younger ages, since Field and Anderson (1985) have found that the linkage between looking and listening to television gets weaker with age, and since Pezdek, Simon, Stoeckert, and Kieley (1985) found that text and television comprehension are positively correlated in young adults. Nevertheless, the possibility that television viewing emphasizes skills which do not transfer well to reading or listening should be considered open.

Friedlander and Cohen de Lara (1973) have argued that children's tendency to listen to television is highly predictive of their school achievement in language and reading. They developed a device which presented a TV program such that the sound would become degraded, but this sound degradation would be removed for 15 seconds if a child pressed a switch. Out of 44 five- to eight-year-old children, 11 were observed to obtain a normal soundtrack for less than a criterion of 65 percent of the program. All of these 11 children "...presented a variety of language and reading dysfunctions" whereas none of the other 33 children did. Dysfunctions were assessed by "extensive interviews with the children's teachers and the school principal". This study, which has not been followed up, is strongly suggestive that listening to television is diagnostic of reading ability. The study does not clarify the issue of whether television actually affects listening ability, however.

If television does have a negative impact on reading acquisition by some children, as the evidence weakly indicates, it is clear that there are numerous possible explanations of the effect. Simple displacement effects or lack of practice making eye movements are not supported by research findings. More likely explanations include: 1) Television reduces interest in reading by itself or in combination with parent attitudes and family environment. 2) Television reduces task perseverance and this affects reading acquisition. 3) There is initial negative transfer to reading acquisition from listening or comprehension skills specific to watching television. Other hypotheses are, of course, possible, and there is little evidence at this time sufficient to strongly indicate one over others.

Summary of the Cognitive Effects of Television

There is little we can say with assurance about the effects of television viewing on cognitive development. In considering all the research combined, we are more impressed by the lack of demonstrated influence than by the few findings of effects. A true lack of influence is itself difficult to demonstrate, and there is not nearly enough research done to safely conclude that there are no important cognitive effects of television viewing. Unfortunately, not only is the research sparse, with few unambiguous results, but much of the work is not of excellent quality, nor are earlier studies as yet followed-up with more detailed and carefully controlled replications. With these cautions in mind, we will summarize the findings.

It is fairly clear that television viewing displaces radio listening and comic book reading. There are also consistent indications that organized outdoor activities (especially sports) may be displaced by television. There is little consistent evidence that television viewing displaces leisure time reading (other than comic books) or homework. There is little reading done by children anyway, and homework is often done with television. While there are a few hints that listening to radio drama might be a valuable activity in training listening skills, there is little radio drama available for children's listening, in any case. On the whole, there is little evidence that television viewing *displaces* valuable cognitive activities.

While television certainly influences children's knowledge base, there is little evidence that this has academic relevance. A few studies indicate that vocabulary may be increased by TV viewing, but the effects do not appear to be large, or completely consistent. Knowledge base effects, we believe, are most likely the largest and most important, yet they constitute a relatively neglected area of research.

Most research directed at effects on specific cognitive processes has been concerned with the influence of cinematic codes that are used to imply particular kinds of information or to simulate cognitive activities. The research on this issue has concentrated on training specific cognitive skills, especially attentional focusing and spatial abilities, by means of demonstrating those skills with particular cinematic codes. The research is convincing that cognitive processes can be influenced by such direct training, but there is little evidence that under conditions of normal entertainment television viewing such effects occur. This is an area of possible influence that requires further investigation in order to determine its actual importance.

A scattered group of investigations indicates that television viewing may have an influence on task perseverance and impulsivity. The influence, however, is positive in some studies and negative in others, and may depend on the particular kind of content viewed. Only one experiment examined the influence of rapid pacing, but it found no short term effects on preschoolers' task perseverance or activity levels. This again, is an area which indicates possible effects, but the combined research does little more than raise the possibility.

While a great deal is written about television's influence on imagination and creativity, again, there is little consistent evidence. Exposure to well formed radio stories may stimulate the imagination of children who understand these stories more than if animations are added to these stories. It has not been demonstrated that the quality of TV inspired imaginativeness, however, is of poorer quality than that induced by audio alone. In addition, television has not been shown to reduce the capacity for or frequency of imaginative play. One study suggests that while imaginative play is unrelated to television exposure, heavy viewers may experience more unpleasant fantasy thoughts. One investigation of television's arrival in a small town provides convincing evidence with one measure, that there may be a negative impact on creativity. With another measure, however, there was no effect.

Finally, while there has been a great deal of research on the relationship of TV viewing and reading, the outcome of all this research is not impressive. There may be a slight negative effect of heavy television viewing on reading achievement with some indication that this effect may occur at the earliest stages of learning to read. The reason for this effect is obscure, but appears not to be due to displacement of leisure time reading or lack of practicing eye movements. Possibilities include a reduced interest in reading somehow produced by TV viewing, or negative transfer of skills appropriate to the cognitive processing of television, but which are less appropriate to reading. Recent studies suggest that any relationship between TV and reading is probably trivial relative to factors such as time spent reading books and family attitudes toward reading.

In sum, there are a few hints that there may be cognitive effects of television viewing, but none of the evidence is convincing as it stands. Many investigators have suggested that the effects vary as a function of age, sex, IQ, SES, and so on; indeed, many studies report complex interactions with these variables. Unfortunately, the research to explore the possibility that some particular subgroups of children may be

affected in different ways and *why*, has not yet been convincingly done. It should be considered possible that television is intellectually stimulating to some subgroups, of little impact on others, and retarding to still others. Even more likely, we believe, is that family attitudes toward reading, schooling, and other intellectual activities provide the crucible within which subgroup effects might occur. Sorting these out is not an easy task.

Many possible effects of television have yet to be investigated at all. Examples include the effects on productive activities such as writing, or on the ways children deploy attention in academic settings. Pursuing these possible effects, we believe, should be done with consideration of the cognitive activities involved in watching television itself. Knowing what children do, behaviorally and cognitively, when they are with television, should help with understanding what may transfer to other situations.

Modifiers of Effects

Concern about the effects of television has produced several proposals for ways to modify or ameliorate these effects. Chief among these are suggestions that parents should coview television with their children, and that schools should adopt programs which teach "critical television viewing skills." While parent coviewing and critical viewing skills programs are to a great extent directed at modifying the effects of television on social and economic attitudes and behavior (e.g., violent content, stereotyping of social roles, advertising), there has also been some interest in modifying the presumed cognitive effects of television viewing. Since, as we have seen, the cognitive effects of television viewing cannot be identified with any certainty, it is difficult to determine whether parental coviewing or critical viewing skills programs have any modifying effects. It is, of course, possible that coviewing or critical viewing skills programs have their own direct effects. Not surprisingly, given the paucity of research on effects of television, there is even less research on modifiers. We will briefly review the relevant work.

Parent Coviewing

We have already noted that young children's comprehension of television increases when an adult provides commentary relevant to comprehension, especially forming connective inferences. We will assume that increased program comprehension *is* a potential effect of coviewing. It has also been proposed that parent coviewing can provide role models for appropriate viewing behavior, and through expressions of approval and disapproval, can modify the child evaluations of television content. Presumably, these factors can modify in one form or another, the impact of television. The question here is, aside from direct effects of parent coviewing on comprehension, are there more general effects?

Lemish and Rice (1986) observed interactions of parents and their toddlers (6 months to 30 months) while the TV was on. They observed a rich set of teaching interactions, especially around language issues. Vocabulary teaching, in particular, appeared to be a major activity in the interactions they observed. If, indeed, more vocabulary is learned interacting with parents in the context of television than with television alone, then parent coviewing would have a general beneficial effect. This, however, has not yet been demonstrated.

Morgan (1982), using questionnaire items, classified parents of sixth to ninth graders as having high or low involvement with their children's television use. Children of low

involvement parents showed a negative correlation of amount of TV use and achievement scores. Content areas positively associated with parent involvement with TV were reading, math, and language usage. Unfortunately, it is not clear whether questionnaire responses to "involvement" questions are actually reflected in coviewing differences. More likely, parents who are more concerned about their children's TV viewing are also concerned about and active in promoting their children's cognitive development in general.

In her dissertation research, Field (1987) analyzed reported coviewing in the home observation study of Anderson et al. (1985). She analyzed viewing diaries from 334 families in the Springfield, Massachusetts metropolitan area, each with a child near the fifth birthday. She found that these 5-year-olds were alone with television 15 percent of the time, were with their mothers 27 percent, and with their fathers 18 percent. The remaining time was with siblings, friends, baby sitters, and the like. There was no evidence that coviewing interacted with sex of child or sex of parent. That is, mothers did not coview more with daughters, or fathers with sons. Using global parent estimates, Vaughn and Moran (1980), report 27.5 percent viewing alone for preschoolers; with similar global measures, Field found parents estimated 21 percent viewing alone; this correlated .30 with diary measures.

Field found that the percentage of the child's time with television that was spent with a parent was almost completely determined by the total amount of time parent and child each spent with TV. That is, the more time spent with television by each member of the coviewing pair, the greater the percentage of time spent together. These results were well explained by a model which hypothesized that parent-child coviewing is essentially a random event determined by total viewing time. Hours of coviewing was not predicted by parents' education, SES, attitudes toward television, or a variety of other variables.

Field examined coviewing of *Sesame Street*, a program for which coviewing has been especially urged by the producers. She found that there was significantly less parent--child coviewing for *Sesame Street* than for television in general (she did not analyze coviewing during other children's programs). During *Sesame Street*, the 5-year-olds viewed alone 18 percent of the time, coviewed with mothers 14 percent of the time and with fathers 4 percent. Again, there were no sex differences.

These findings suggest that not only do parents not make any special effort to coview television with their children, they are actually less likely to coview during *Sesame Street*, despite urging that they do so. The most plausible interpretation of these findings is that television is sometimes used by the parent as a means of keeping the child occupied while the parent engages in other activities (cf, Gadberry, 1974). Lemish and Rice's (1986) characterizations of mother-toddler interactions during *Sesame Street*, add credence to this interpretation. They observed that while mothers did not often spend extended periods of time in the TV room, they did enter and exit frequently, and in doing so interjected comments that focused their child's attention or explained television content. Thus, it may be that the potential effectiveness of coviewing is not a linear function of time spent together in the TV room. Nor is it clear whether parents are more likely to use an educational program such as *Sesame Street* for this purpose than children's entertainment programs.

Finally, Field examined the degree to which amount of parent-child coviewing was predictive of cognitive performance after total amount of television viewing was entered as a statistical control. Mother-child coviewing predicted worse performance on a test of

impulsivity and did not predict Peabody Picture Vocabulary Test performance, *Sesame Street* comprehension, *Sesame Street* character identification, or task perseverance. Father-child coviewing did not predict anything. On the whole, then, Field (1987) found that parent-child coviewing is essentially a random event determined by total time spent with television, and that it is not particularly predictive of cognitive performance.

Beyond observations with very young children by Lemish and Rice (1986), there is little evidence that idealized coviewing, in which parents provide interpretive commentary, actually occurs. Parents and older children are apparently often in the same room together, with television, but amount of commentary and interpretation that occurs is unknown. Messaris and Sarett (1981), on the other hand, interviewed parents about their interactions with children concerning television. They reported talking about television production techniques, explaining why some event happened and what happens next, and discussions of the reality of depicted events. Alexander et al. (1984) corroborate the existence of these types of conversation in TV viewing by several families. None of this research, however, indicates the prevalence of such discussions.

At this time there is little evidence that parent-child coviewing modifies the cognitive effects of television beyond facilitating online comprehension. Although a fair amount of coviewing occurs, there is no solid evidence beyond very early childhood that coviewing time is extensively used for productive cognitive interactions between parent and child.

Critical Television Viewing Skills

The motivation behind programs to teach children critical viewing skills is similar to the motivation underlying teaching children critical thinking skills in general (Anderson, 1983). The fundamental concept is for children not to be easily persuaded, but to apply rules of logic and evidence and to be able to formulate and test counterarguments. To a great extent, the application of critical viewing skills has been focused on advertising, social behavior on television, and stereotyping of societal roles. There also has been some concern with teaching children about production techniques and distinctions between reality and fantasy as presented on television (Corder-Bolz, 1982). The question here is whether any such programs have demonstrably influenced children's cognitive development.

Preliminary work by Dorr, Graves, and Phelps (1980) examined the outcome of a classroom program that taught children about television production, and the economics of the television industry. Kindergarten to third grade children were extensively interviewed and found to be more likely to judge television content as "pretend". There were also many nonsignificant differences in comparisons with children who did not receive instructions. These results parallel those of Abelman and Courtright (1983). Thus, evaluations of critical viewing skills teaching programs indicate that children can learn about television (see Anderson, 1983; Corder-Bolz, 1982 for reviews). There are apparently no studies of the long term influence of such teaching programs on children's processing of television content or their patterns of viewing.

At this time little can be said about the success of school- based intervention programs which teach critical viewing skills. With relevance to cognitive development, one would hope that studies will examine effects on creativity, knowledge base effects, attentional skills, reading achievement, or the like. Since the evidence is not strong that television actually does influence these areas, however, such research might be premature.

The Effects of Television on Schooling

Correlational investigations usually find a negative correlation between amount of exposure to television and school achievement. Close investigation of these correlations indicates 1) there is some curvilinearity in the relationship such that the relationship is positive at low levels of viewing and negative at higher levels; 2) they become much smaller and often disappear when IQ is entered as a control variable; 3) within ability groupings, relationships may be more consistent -- zero or positive for low ability groups, negative in high ability groups (Morgan & Gross, 1982). It is possible that additional characterizations of subgroups will provide consistent correlational findings.

In this paper we have reviewed the research on television viewing by children as a cognitive activity, the effects on cognitive development, and modifiers of those effects. With each successive section we were able to claim less assurance in the reliability and generalizability of the findings: We have begun to find out a great deal about television viewing itself; we have only some indications of what the cognitive effects of television viewing might be; we know practically nothing about what might modify those effects. The question, then, is what can we say about the effects of leisure time television viewing on schooling? In cognitive terms, we know of no research which attempts to identify an effect on schooling of a specific effect of television viewing. For example, television viewing might have a negative or positive effect on task perseverance, possibly depending on type of content typically viewed. There are no investigations which attempt to identify children who have difficulty with or are excellent in task perseverance in school and which then attempts to causally relate this difficulty or excellence to home television viewing. Given the lack of such research, combined with the lack of generalizable and reliable evidence of the cognitive effects of television viewing, what we say about the effects of television on schooling is purely speculative, although informed by the existing research.

In our opinion, the most likely effects on schooling come directly from the central content of television programming most watched by children. We have already discussed the possibility that television may have a major impact on children's general and specific knowledge bases, and that this impact may have academic relevance, both positive and negative. Unfortunately, except for a few indications that television viewing might increase vocabulary, this is an area almost innocent of investigation.

Television sometimes shows schools, classrooms, students, teachers, behavior in schools, studying, and the effects of schooling and studying. Since observational learning and incorporation of social messages from television are well established phenomena, one must assume that children's expectations of, and attitudes toward schooling may be influenced by television. We do not know of any content analyses of entertainment television which show how schooling is represented. Having been children who watched television ourselves, it is not hard to remember numerous instances of television depicting boring teachers, bored students, seemingly irrelevant content, unpunished disciplinary violations, disrespect of teachers, and so on. On television, school formed a basis for social interactions between children, and studying was something one left in order to have an adventure. We do not know that such presentations of schooling actually have a negative impact on real schooling, but such a possibility strikes us as one of the most likely and important direct effects.

Considerations of the attentional strategies children apply to television suggest the possibility that these strategies may be transferred to school situations. Strategies of

ignoring adult male voices, dividing attention between the TV and concurrent play activities, and monitoring the auditory environment for cues as to when to pay full attention, appear to be characteristic of TV viewing. If the young child initially applies these strategies to the school situation, inappropriate patterns of attention may result. In addition, some research indicates the possibility that very young schoolage children cannot easily separate auditory attention from visual attention. It is possible that television reinforces this inability so that the ability to listen without a concurrent visual display may be somewhat retarded.

Since the findings concerning television's effects on task perseverance are not consistent, it is difficult to determine the likely effects on schooling. This is an area that clearly needs further investigation, given its potential importance to education. Preliminary indications are that some kinds of program content may reduce perseverance (violence, action), other kinds of content may help increase perseverance (some kinds of educational programming).

Findings that cinematic codes can influence analogous cognitive processes leads to no obvious implications for schooling, especially in the absence of a demonstration that such influence normally occurs. There is at this time no evidence that overall spatial, inferential, or attentional focusing skills are influenced by or even correlated with leisure television viewing. Although there is some evidence that math achievement (which might be most affected by influences on such skills) is negatively correlated with TV exposure, especially in high IQ children (Morgan & Gross, 1982), this might be due as much to the fact that math homework is more likely to be done during television viewing (as compared to other kinds of homework) than to any direct influence of television itself. However, it has not even been demonstrated that homework done with television is of less quality or quantity than homework done in silence.

Another possible area in which television might affect schooling is in tasks requiring productive cognitive skills, such as writing. While there is some evidence that television might affect productive verbal creativity, this has not been examined in relation to schooling. Again, we believe that this is an important area for further work.

Finally, there is weak evidence that television has a small negative impact on reading achievement. If so, then it is not clear what the implications are for schooling, since there is no indication whatsoever as to *what aspects* of reading are negatively affected. Without clear evidence on the issue, it is unlikely that the nation can be mobilized to reduce children's TV viewing. Moreover, without knowledge of what aspects of reading achievement are affected, it is not clear how schools could compensate. Again, this is an important area that requires substantially more sophisticated research than mere calculations of correlations of TV exposure and general tests of reading achievement. It should be pointed out that the most recent longitudinal investigations have not found evidence supportive of a causal relationship between amount of TV exposure and reading achievement. It may be that if the effect is real, it is very small and limited to specific subgroups of vulnerable children.

Because television is a salient aspect of the home environment, and because children spend so much time with television, it would appear that TV *must* have a major impact on schooling. If it does, the nature of that impact has yet to be determined. The failure to find obvious effects must always raise the possibility that observed negative correlations of television exposure and school achievement are due to mutual causation by a third factor. The most obvious third factor is the the environment in which the child is raised.

Those things which cause a child to watch a large amount of television may also cause poor school achievement, with little direct role played by television itself. This possibility may be unpalatable to those who, for a variety of reasons, do not like American entertainment television, but in the absence of evidence to the contrary, it is a possibility which must be seriously considered.

Critique and Suggestions for Future Research

Our failure to find important or even reliable cognitive effects of television viewing should not be taken to mean that we have shown there are no effects. Rather, research has been sparse, with only a few research groups showing consistent interest in the problem. Despite the relatively high volume of public rhetoric concerning the effects of television, funding for research has been sporadic, leading to what Hornik (1981) referred to as the "fly-by-night character of the field" which produces occasional results, but rarely with replication and verification. Another reason that there is so little solid work is that the problem is difficult. In this section, we will consider some of the difficulties in doing research on the cognitive influence of television, and suggest approaches to dealing with those difficulties. We will then suggest possibly fruitful approaches for future research.

Difficulties of Research

Researching the influence of television on cognitive development presents many of the same difficulties encountered in prior research on social behavior, plus some new ones. Difficulties we see as especially apparent in this research area include overcoming investigator preconceptions, diverse publication practices, description and measurement of television as a stimulus, description and measurement of television viewing behaviors, deciding what behaviors, capacities, and abilities to measure as potential effects, and framing plausible and testable theories. We will briefly describe each of these problems and suggest some approaches to dealing with them.

Investigator preconceptions. Scientific neutrality is an ideal that is difficult to attain, especially for issues associated with strongly and widely held opinions formed in part by political and social philosophies. This is not a problem unique to the social and behavioral sciences (witness scientific controversies over the health effects of low level ionizing radiation, the plausibility of computer control over distributed space defenses, and many others), but the social and behavioral sciences most frequently confront problems where strong popular preconceptions exist. The influence of television is one such area.

It is widely believed among academics that research projects associated with the television industry will simply not report possible negative consequences of television viewing. The economic interests and possible biases underlying such projects are obvious. On the other hand, academic research which is foundation or government funded may be biased by popular preconceptions about the negative influence of television. This problem has been recognized as having influenced research design and interpretation of findings (Cook, Kendzierski and Thomas, 1983). Singer and Singer (1983) for example, explicitly acknowledge the bias in their own and others' research, a bias that strongly tilts to the negative. Cook, et al. (1983) argue that negative bias pervaded the television research reviewed in the 1982 NIMH Report. They also warn that where the effects of educational and prosocial TV programs are concerned, we must be careful not to unwittingly commit the same mistakes in the opposite direction, i.e. introduce positive bias, by looking exclusively for positive effects.

Some writers who adopt "critical" perspectives rooted in Marxist philosophy argue that there simply can be no neutral empirical or theoretical science, that all observation and interpretation is guided by implicit preconception and that pretenses to the contrary are at best delusions. While we understand that preconceptions and biases exist, and that analyses and acknowledgement of biases are useful and important, we also believe that a serious effort must be made by investigators not to prejudge issues. Objectivity is an ideal which is met with difficulty, but objectivity must be attempted and combined with clear statements of research goals, theoretical expectations, methods, analyses, and interpretations. Such efforts, we believe, have the best chance of informing a rational debate, leading to real progress in understanding television's effects. Only then can reasonable action be taken to reduce or enhance the influence of television in accord with the goals of the society at large.

Diverse publication practices. One can find theory, research, commentary, diatribe, sensationalism, and considered analysis concerned with children and television in a large variety of printed and electronic sources of an interdisciplinary and international character. This diversity of sources is associated with a wide range of standards of evidence and of discourse, and as such, represents a substantial problem of search and selection for the serious scholar and researcher.

The problem is exacerbated by the large number of substantive areas related to the central problem. These include vast areas of child development, cognitive science, communication studies, education research and practice, linguistics, marketing and advertising research, the neurosciences, pediatrics, philosophy (especially semiotics), psychiatry, sociology, and television production. While the problem of search is helped somewhat by the existence of digital bibliographic databases (e.g., the ERIC system), and by published bibliographies (e.g., Murray, 1980), there is still a serious problem of selection. This problem is most often solved by ignoring most of the literature not conforming to an investigator's own scholarly paradigms. Sometimes this solution is appropriate since alternative approaches to an issue are not always commensurable and each should be developed in its own terms. Eventually, however, methodologies, theories and answers must be brought together and compared for their usefulness in terms of understanding and action. It is clear that interdisciplinary organizations, meetings, and publications must ultimately serve this purpose.

Perhaps reflecting our own training and discipline (developmental psychology), we strongly suggest that scientific reports should meet certain minimal standards. In particular, we believe that reports of empirical research should be published in research journals which require independent review by scientific colleagues for logical consistency, clarity and appropriateness of methodology, appropriateness of statistical analysis, and the like. Present practices all too often include presentation of research results in unrefereed books and book chapters, unpublished conference presentations, or in journals with minimal scientific review. Especially common by some investigators in television research is the shoddy practice of finding a treatment difference that is not statistically significant, calling it a "trend", and in the summary, discussion, or in subsequent publications referring to it as a solid result. There is an old joke about lying with statistics, but if, as researchers we persist in such practices, the resulting inconsistencies and muddle will eventually mean that the joke is on us.

A particularly egregious example of an inappropriate report, we believe, was the article by Halpern (1975) in the most widely read communications journal. Halpern, the

reader may recall, described 2-year-olds who were hyperactive and who compulsively recited numbers and letters learned from *Sesame Street*. Halpern suggested that the children's bizarre behavior was "directly traceable to *Sesame Street*". He provided no methodology and no consideration of whether normal 2-year-olds who watched *Sesame Street* also recited numbers and letters. There was no consideration of alternative explanations of these observations. Despite the many inadequacies of this report, there was widespread national publicity describing the "*Sesame Street* Hazard". The first author of the present paper (Anderson) personally received telephone calls from highly concerned parents asking if they should forbid their preschoolers from watching *Sesame Street*. The dangers to society, to real progress, and to the credibility of research by such slipshod scientific publication practices should be apparent. The burden of responsibility should be not only on the individual investigator, but on the academic and scientific bodies that determine the editorial practices of their journals, as well.

Description and measurement of television as a stimulus. "Television" is the independent variable in questions concerning its influence. The problem is that "television" is a surprisingly complex concept, a complexity not often realized or explicitly acknowledged in research (cf, Anderson & Bryant, 1983; Salomon & Cohen, 1978).

One of many complexities is that television, as experienced in American homes, is a changing technology. Television of the 1950's, for example, was black and white, frequently consisting of live broadcasts, and the zoom as a technique was not yet invented. Animation was relatively rare in children's programming, and since videotape was not yet used, many programs could not employ the rapidly paced editing and special effect techniques characteristic of much contemporary broadcast television. Program choice, of course, was limited to several channels. Historical changes in the technology of television must be considered in meta-analyses comparing studies conducted in different decades. This, of course, requires specification of those aspects of television as a stimulus or television viewing as a behavior that are hypothesized to be exerting an effect. Unfortunately, such careful consideration and specification is often lacking. This leads to research that yields "indications" but no conclusive results. Of course, contemporary television technology is still rapidly evolving. With digital technologies, videodisk, and videotape reaching widespread penetration into American homes, television may no longer be consistently characterized by "uninterruptibility, nonrepeatability, and uncontrollability" (Dorr, 1986). The impact of such changes has not yet been explored.

A great weakness in much of the research we reviewed in this paper was failure to characterize the content of television children are exposed to, rather than just the amount. When considering the content presented on television, however, there are a large variety of possible classifications and measurements. Most typical are broad classifications such as "children's", "animation", "action-adventure", "game show", "daytime drama", and the like. Rarely are these classifications rigorously defined and defended. Dangers inherent in this approach are that the reader self-defines the meaning of a classification based on his or her own TV viewing experience, with consequent vagaries of personal interpretation. Research employing such classifications may thereby be difficult to replicate. Furthermore, programs that satisfy these broad classifications have many differences, as well as similarities. Thus, ascertaining the *cause* of observed effects is made more difficult. Recent attempts by the CRITC research group at the University of Kansas to provide explicit definitions for program classifications relevant to cognitive issues are a step in the right direction (Huston et al., 1987). These classifications are already being employed by other researchers so that replication of findings becomes more feasible.

We believe that the effort to classify, analyze, and quantify television programming must be extensively pursued at a more detailed level. Terms such as "pacing", for example, should be defined at an operational and quantitative level so that programs or viewers' TV diets can be compared. Initial attempts of this nature can be found in Anderson et al. (1977), Huston et al. (1981), and Watt and Welch (1983). Each of these research groups, however, provided substantially different operational definitions of the same general idea! It is clear that providing explicit definitions is a great help in determining the comparability of studies, and therefore, results.

We have already commented on the potential usefulness of a content analysis of academically relevant information presented on the television programs most watched by children. A related task that should be undertaken is a thorough analysis of the intellectual demands and possibilities inherent in television programs of varying kinds. For example, Huston et al. (1987) report that viewing diaries indicate that as children grow older, the temporal integration demands of the programs that they view increase. Anderson and Smith (1984) note that even action- adventure programs popular with young children (such as *Dukes of Hazzard*) require a variety of inferential activities in order to decode many of the simplest action sequences, and Rice (1983) has described the potential of television as a rich source of linguistic information for children. When the intellectual requirements and potentials of television programs commonly watched by children are known, we can better explore the ways in which children comprehend and learn from them.

Description and measurement of television viewing behavior. Too many investigations use general, vague, and untested measures of television viewing. In an important study of the relationship between TV viewing and educational achievement, for example, Burton et al.(1979) used parents' recollections of the amount their children watched television during the preschool period. Since parents are not especially good at providing global contemporary estimates of how much time their preschool children spend with television (Anderson, et al., 1985), it is unlikely that they can do so retrospectively. The finding by Burton et al. (1979) that preschool TV viewing is negatively associated with school achievement is therefore of uncertain meaning: The study may be measuring parents' predispositions toward their children's TV viewing and their resulting reporting biases, as much as it is about TV viewing itself.

Diary measures do appear to be reasonably accurate measures of time spent with TV (Anderson et al., 1985), and since there appears to be some longitudinal stability of individual differences in time spent with television (Anderson et al., 1985; Singer & Singer, 1981), estimates of cumulative exposure are in principle obtainable. Since diaries take a week or more to fill out, and since coding and summarizing them is time consuming and expensive, many investigators will be tempted to use easier global estimates. Such shortcuts will not only introduce random measurement error, but may also introduce unknown systematic biases of recall or estimate.

Unfortunately, time spent with television is not the same as time spent attending to television. Our analyses of in-home time-lapse videotapes of 99 families' TV viewing indicated no correlation between time spent with television and the proportion of that time spent looking at it (Anderson et al., 1985; Anderson et al., 1986). While it is the case that, cumulatively, the more time spent with television generally means more time looking at it, the relationship is far from tight. Work needs to be done describing and classifying individual viewing styles including levels of attention in order to assess their

possible significance in producing television's effects. Certainly, there is a general demand for improved and more detailed measures of TV viewing by both academic and industry researchers. As long as television viewing is treated as a single undifferentiated activity, progress in understanding its effects will be limited.

What to measure as potential cognitive effects. It is not always clear why investigators choose particular measures as potential effects of television. The problem, from the investigator's point of view, may be that one can choose among literally hundreds of published protocols which assess a wide variety of hypothesized cognitive processes. There are essentially three choices open to the investigator: a grab-bag of conveniently administered measures, a select set of measures dictated by hypothesis, or one or more specifically designed measures following from theory. The "grab-bag" approach has the virtue of convenience and the possibility of finding unexpected relationships between variables. Such an approach, however, is necessarily exploratory in nature and virtually never produces conclusive findings.

A more focused but still general strategy is to examine popular claims about the influence of television and subject them to experimental or correlational test. Anderson et al. (1977), for example, tested the assertion that rapid pacing on *Sesame Street* caused children to be restless and with short attention spans immediately following viewing. They used a test of perseverance in problem solving developed as part of the Head Start evaluations, a test of impulsiveness in making visual discriminations, and a ten-minute free play period which was scored for activity level and time spent with each toy. These measures were chosen for their apparent relationships to the capacities and behaviors referred to by the popular hypotheses. The problem, of course, is that an investigator can never be sure that the measure captures the essence of what is meant by popular terms such as "attention span", when there is no accepted technical meaning.

From a scientific point of view, a much better approach than either the grab-bag or hypothesis-test is to choose or develop measures based on a testable theory of television's effects on cognition. This approach has been nearly lacking in research on the cognitive influence of television with the notable exception of the program of research and theory by Salomon and his colleagues. Salomon adopted, adapted, or developed a large number of specific measures which were related in particular ways to his theories of the internalization of filmic codes and amount of invested mental effort. While Salomon occasionally fails to describe these measures in detail sufficient to allow replication, it is usually clear what the measure is and what its role is in the study. Salomon is also one of the few investigators who consistently and programmatically attempts to relate cognitive effects of television to the cognitive processes involved in using television. While his theories, studies, and findings are not always models of clarity, the approach of relating cognitive effects to cognitive use is laudable and rare. We have tried to use this approach in organizing this paper, and we believe it will be the most productive in future research.

Suggestions for research

Because children's television viewing is a complex activity which takes place in a complex and variable environmental context, the effects are surely varied and complex themselves. Consequently, we do not believe that any plausible single investigation is going to be crucial in revealing what are the effects. Rather, the process will be incremental and based on consistent and committed programs of research. Throughout this paper we have identified major gaps and problems with existing research; we have also suggested approaches to filling these gaps and dealing with the problems. We will not

summarize these here, but rather, indicate a few approaches that may be of particular relevance to the interconnections of TV viewing, cognitive development, and effects on schooling.

Longitudinal studies of the type pursued by Roberts and his colleagues (Ritchie et al., 1987; Roberts et al., 1984) have considerable potential in identifying effects. As readily admitted by the investigators, however, these studies have suffered somewhat from a lack of reliable and appropriate measures, especially with younger children. Furthermore, since the youngest children were already in school (second graders), they found that there was little longitudinal variability in TV viewing and reading achievement. This lack of longitudinal variability essentially means that one cannot identify later effects based on earlier changes in behavior. The phenomena of concern were already well established in the lives of the children, and there was little subsequent change.

It is clear that future longitudinal research should begin early in the preschool years before TV viewing is well established as a consistent behavior, and the research must be pursued until the children are well into their elementary school years. Such longitudinal research *must* contain assessments of the intellectual environment provided by the family, including attitudes toward schooling, reading, and TV viewing. Working with preschoolers is not easy, and special care has to be taken in developing and applying assessments of TV viewing and cognition. While such research is very expensive and requires extraordinary commitment on the part of the investigators, it is perfectly feasible and is essential.

Experimental approaches in natural contexts should be pursued to a much greater degree than has been the case. Such experiments can involve 1) manipulating amount of assigned homework; 2) manipulating amount of reading; 3) manipulating amount of TV viewing; and 4) manipulating TV viewing diet. Although Hornik (1981) was skeptical about the generalizability of such experiments, we believe they can be highly revealing, not only about the effects of television, but about the possibilities for change. For example, if assigned homework is increased, it is of considerable interest whether prior amount or kind of viewing is predictive of the completion of homework assignments. In turn, it is of interest whether the completion of homework assignments changes the kind or amount of TV viewing. A wide variety of questions can be posed based on the other kinds of manipulations, and answers to these questions can cast considerable light on the use of television, the nature of its effects, and the potential for change.

In general, however, such broad-based experimental and correlational studies must be complemented by careful content analyses, experimental research, and theory which illuminates the cognitive nature of television viewing relative to potential effects. In other areas of research the combination of large scale investigations in natural contexts and careful experiments in laboratory contexts has been extremely powerful, and have provided great scientific discoveries of practical importance.

Such a success story is not beyond the reach of television researchers. While the problem of the cognitive effects of television is difficult, it is by no means intractable. The pervasiveness of the medium, the amount of its use, and the widespread public concern suggest that solving the problem will be worth the effort.

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